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EDITORIAL

THE VALUE OF THE ARCHITECTURAL MAGAZINE—A QUESTION OF POLICY—THE ARCHITECTURAL SPECIALIST

WHEN an architect puts five dollars into a subscription to an architectural magazine, he does it because he wants to keep in touch with the latest work, to find out what is the general trend in design so that he may not lag behind his competitors. He also buys it from much the same curiosity which impels us to buy the daily newspapers; he looks in it to find out what Smith and Jones are doing in loft buildings, and what Brown and Robinson are doing in churches, although he, himself, may never have designed either a loft building or a church, and may not have the expectation of doing so. In other words he looks at the pictures of their work just as he reads the war news, not to gain information for his own use, but because he wants to know what is doing.

It is unquestionably part of the function of an architectural magazine to supply current architectural material to the profession, but few people realize when they subscribe to this monthly magazine and get twelve copies in a year, what an enormous amount of valuable matter has actually come to them, and that they are buying not only a record of professional events but the making of several good books.

The average number of ARCHITECTURE has in it fourteen plate pages which are printed only on one side of the paper and are made convenient for filing; beside this it has twelve or fourteen more pages of illustrations, making during the year a total of over three hundred pages, probably more nearly three hundred and fifty pages, of illustrations which are selected with the greatest care, not only to show current work, but also to illustrate work which is worth being kept as part of the architect's library. The measured drawings are also of great value as showing just how certain results are procured. We find that the twelve numbers have expanded to two very large volumes, which are printed better than most of the high grade architectural books, and constitute a body of material which would otherwise be inaccessible. If any one should come to the architect with a book containing over three hundred full page illustrations and twelve especially made measured drawings, besides much text matter, and offer to sell it to him for five dollars, he would perceive that he was getting a bargain, and while he probably does realize that so much material cannot be obtained at such a low price in any other way than through the architectural magazine, he is apt to dispose of the matter rather carelessly by saying "Of course the advertisements pay the freight."

Now this is perfectly true, since it is by the quiet, steady and unobtrusive support of the advertisers that this or any other magazine of similar size and quality is made possible, and we want the subscribers to ARCHITECTURE to realize this. It is something of which we are not ashamed.

We know that our advertisers are repaid for their expenditures by the use and the specification of their goods by the architects who are subscribers to this magazine, and we know, also, that in the advertising pages are found things of value to the architects. New materials and new processes, many of them worthy of text consideration, are being constantly published as advertisements. These are things which the architect cannot afford to pass, any more than he can afford to be without the knowledge of design which he gains from the illustrations, and if our architects realize that the value of the magazine is made possible not alone by the subscribers and contributors, but also by the advertisers, they will likewise realize that frequent consultation of the advertising pages (resulting in an even greater value to the advertisers) will enable the publishers to increase the number of plates; the magazine would thus be of increased service and utility to the subscriber. We have finally arrived beyond the point where the value of advertising can be discussed only from the standpoint of the advertiser; its utility to the subscriber can be frankly acknowledged by the publisher, and while it is unnecessary to say that the primary aim of this magazine is to publish only material of the highest artistic merit, we also desire to bring our advertisers into the closest possible touch with the architects and would welcome any suggestions which will facilitate this end.

THE foregoing discussion has suggested another subject on which we would like to have advice from architects. What sort of material do the architects most desire to have illustrated, and how do they prefer it to be shown? We believe we have been fairly successful in using the right things and in presenting them in the right way, and probably the best proof of this is in the fact that our subscription list has shown steady and healthy growth, but we are by no means convinced that we are publishing the ideal architectural magazine, and we would like to know our shortcomings as seen by our subscribers. We have been criticized by some of our competitors in the magazine field for not fully publishing certain buildings; we have also been criticized by the same competitors for not publishing a sufficient number of subjects; we have been criticized by certain of our subscribers for not publishing enough work of large size and great expense, and by others that we were publishing large work to the exclusion of small.

The policy of the magazine should be to publish work of architectural merit without regard to its size, and to use no more illustrations of a building than would enable the reader to gain a reasonable knowledge of it, thus utilizing the space for as many different subjects as possible. Of course it is impossible to completely satisfy any one class of readers without alienating some other class, and we have been compelled to take "the dangerous middle course" of using both large buildings and small without much regard for uniformity or subject. Illustrations of the small country house are perhaps not very valuable to the large metropolitan office, but illustrations of the great city hotel are often less valuable to the architect who works in a small middle western town where such a building is impossible; yet we cannot afford to neglect fine work simply because it is big, any more than we could afford to fill the magazine entirely with examples of small work of no matter how great artistic quality, because certain of our subscribers seldom had large work to do.

The question of policy in the selection of subjects and in the method of presenting them is one which has puzzled us sorely and not infrequently we find ourselves either obliged by lack of space to forego publication of several interesting smaller designs so that we might have plates to adequately illustrate a larger building, or we find ourselves obliged to reduce the space assigned to the big building because several others of lesser cost but equal artistic merit are also at hand. This is a point on which a free and full expression of views from our subscribers would greatly assist us in making decisions and thereby enable us to give more exactly what our readers want.

NOT an inconsiderable number of the profession have come to be known as "specialists" on one subject or another and this probably not through any signal desire on the part of the man so denominated to devote himself entirely to one line of work. We all know Mr. Platt as a country house man; Mr. Goodhue as a church designer; York & Sawyer as bank specialists, and it seems rather a pity that the field of utility of these men, as well as many others, should be limited by a general acceptance of them as "specialists," and the fact that the public regards a man who can do one thing extremely well as being incapable of doing anything else. Of course none of the men mentioned, and probably no other "specialist" has done only buildings in his specialty; Mr. Platt for example, has just completed a newspaper building in Cleveland; Mr. Goodhue is doing a Colonial building for the Panama-Pacific Exposition; a hospital designed by York & Sawyer was recently illustrated in these pages; and architects realize that the skill and talent displayed in the design of these buildings was not less than in the class of buildings which these architects customarily executed.

It may be wondered if the general public should be encouraged to develop its tendency toward looking to specialists, and although it is for the benefit of design in the country at large that men of proven ability be given most of the work in the fields where they have made themselves particularly notable, the great trouble is that inferior men who have done one or two buildings of a certain type become known as specialists, and are resorted to without the public being aware that the mere taking up of a single line does not make a man a capable architect. We doubt the wisdom of becoming a specialist, for the skillful designer is equally capable in all sorts of problems, and the unskillful designer will never produce satisfactory results regardless of his knowledge of requirements.

The bad specialist is liable to get work in what he considers particularly his line, simply because of the sheer bulk of his accomplishments. The layman is apt to think that if a man has done sixty-two railroad stations he must be good at this sort of thing. The layman does not understand plans at all well, and though the public taste has been educated during the past few years, he is very likely to mistake ornamentation for beauty, and therefore employs a specialist, instead of finding a man whose design is sympathetic to him, and whose reputation or ability has been proven in other fields.

A notable example of the disastrous tendency of specialization has been on our skyscrapers; the average layman believes that an architect has to have built a number of sky scrapers before he knows how to construct them so they do not fall down. He does not realize that the office boy with six month's experience in an architect's office could probably erect a building as substantial as those erected by D. H. Burnham & Company, for he would go to competent engineers for his structural design and his mechanical equipment, just as the architect who has done a dozen skyscrapers proceeds, and this tendency toward giving work to people who have already done skyscrapers has resulted in a mediocre quality of tall buildings, since the men who began the construction of skyscrapers were inclined to look upon them rather from the utilitarian than from the artistic view point.

Among the architects who have never done anything costing over $20,000 there may be many who are "mute inglorious Miltons" as regards skyscrapers, and the world is poorer because they have never had opportunity to develop their theories and show their ability.

On the other side of the question the loss to the public seems to be quite as important. Mr. Goodhue has contributed some magnificent churches which have immeasurably enriched our civilization by precept and example to other men, as well as by their existence. Would not Mr. Goodhue perform a like service in another field were the opportunity afforded him?

Mr. Platt's country houses have shown us the way, and while Mr. Platt certainly would never do a Gothic church like those Mr. Goodhue has executed, it is quite possible that he might convince us, had he the chance, that the Classic style affords circumstances as favorable for original thinking in this class of buildings as does Gothic. Therefore, the growth of specialism in design should be discouraged, and the architects must lead the way by teaching the public that a good designer is a good designer, always, whether his problem be great or little.

BANKING HOUSE, J. P. MORGAN & CO., NEW YORK

TROWBRIDGE & LIVINGSTON, ARCHITECTS

THE completion of the new banking house for Messrs. J. P. Morgan & Company marks another advance in the evolution of modern business buildings.

In the Bankers' Trust Company Building, Messrs. Trowbridge & Livingston created many new precedents for high buildings; in the Altman Building, they revolutionized the type of great mercantile houses, disregarding all preconceived ideas and giving to the city a structure of distinguished beauty which experience has shown to be, from a practical point of view, the most successful of any of its contemporaries—so now in the Morgan Banking House, they have established a new and high standard of artistic and practical excellence for private banks.

From a technical point of view, its chief interest lies in the unreserved acceptance by the architects of a number of unusual physical conditions. The curious shape of the lot—an irregular pentagon with one re-entrant angle—and the requirement of placing the main entrance at the acute angle formed by Wall and Broad Streets, constituted the underlying difficulties of the plan and were the governing factors in determining the general form of the building. The desirability of having the main banking room, which is on the first floor, entirely clear and uninterrupted by interior columns or walls, prescribed a complicated system of overhead construction, and the necessity of using the entire available area precluded the possibility of any sacrifice of space to produce a symmetrical room. Thus debarred from the use of the customary architectural devices by which irregularities of plan are ordinarily disguised, it became necessary to depend entirely upon a purely decorative treatment to give to the banking room the appearance of noble proportion and dignified stateliness essential to a banking house of so eminent a character. The key note of this decoration is simplicity, both in color and in detail. The walls are devoid of pilasters, columns or other architectural features which might accentuate the peculiarities of the room. Above a marble wainscot about 11 feet high, the walls are covered by large mosaic panels, set in marble frames, separated by narrow panels. The large panels are surrounded by a simple border of colored mosaic and the narrow panels are filled with arabesques of mosaic in soft colors. These arabesques are composed of a series of trophies representing all the various industries. The ceiling, 30 feet high, is a combination of hexagonal and circular coffers, which, by a very ingenious arrangement, contributes in no small degree to the disguising of the peculiar shape of the room. The marble throughout is a rose colored Tennessee marble of a soft warm shade. This, with the grayish color of the body of the mosaic, gives to the whole room a quiet, warm tone of color which tends to make the walls recede and the angles disappear. The public space is surrounded by a screen separating it on one side from the working portion of the bank, and on the other from the partner's space. This screen, which, like all other parts of the building, is in the style of the Italian Renaissance, is of the same marble and consists of columns and pilasters connected by a low wainscot and by bronze and glass screens, surmounted by a full entablature. The models and carving were executed by Donnelly & Ricci. The frieze of this screen is an extremely interesting and beautiful work of the well known sculptor, Charles Keck. Mr. Keck, who is one of the Fellows of the American Academy in Rome, was given for his subject the mythological representation of the various branches of human knowledge and endeavor. Upon one side, the industries of the sea, the earth, and the air are depicted through the medium of Greek mythology, and on the other side he has borrowed from the North American Indian Mythology the legend of "Hiawatha" who is supposed to have given to the Indians their knowledge of agriculture and the arts. Both in composition and in execution, this frieze is a work of great beauty and of artistic value. The floor of the public space is also in the style of the Italian Renaissance, being designed after the manner of the celebrated floors of the Church of San Miniato in Florence and the Cathedral in Sienna.

All the furniture for the bank has been especially designed for the purpose, to suit the location and to harmonize with the decorative scheme. On the south wall of the banking room, in that part of the partners' space in which Mr. Morgan has his desk, there is over the mantel a large marble frame containing a portrait by Boccaflor, of the late J. P. Morgan.

The second floor of the building is occupied by the private offices of the partners, with rooms for their secretaries. Each partner has a private office or library, facing Wall and Broad Streets, Mr. Morgan's office being in the center, over the entrance. Each one of these rooms is decorated in a different manner to suit the individual tastes of the partners, but in general they are wainscoted in English oak and are of the later English periods. In each room there is an open fireplace, chimneys for which are connected together in the upper story and operated by forced draughts so that either wood or soft coal fires may be used. An oak wainscoted corridor which is lighted by windows from the central court, connects these private rooms, and a private elevator connects this corridor with the partners' space on the first floor. The secretaries' rooms are placed on the east and south sides of the central court and have access from a corridor to the main elevators and elevator in the rear.

On the third floor are two private dining rooms with pantry, kitchen, etc., and working space, all located on the central and rear court.

The fourth floor is given up to working space, two bedrooms, barber shop and janitor's quarters. On this floor there is also an open roof garden facing the Stock Exchange, with a pantry, where luncheon can be served in fine weather.

The basement floor, which is entered from the lower level at the south end of the Broad Street front, is given up to the Transfer Department and the service entrance to the building. In the rear of the building is the great vault and a large book vault. The vault itself is one of the largest in existence, being three stories in height and about 23′ x 27′. The door of this vault is circular, about 8′ in diameter, 5′ thick and weighs fifty tons. In addition to this, the vestibule is a mass of steel, weighing about 30 tons. The walls of the vault are built according to the very latest ideas of vault construction and are impregnable. As the foundations of this building are of the cofferdam type and are laid upon the solid rock 60 feet below the street, the space contained within them is available to their full depth. All this space, which is divided into three floors, is occupied by the machinery for the building and storage vaults and rooms. A large part of this space is given up to the heating and ventilating system which supplies, by forced draughts, fresh air at the proper temperature to every room and every part of the building. All the appointments of the building are of the very latest and best types, and have been studied to give the most practical and economical results. The exterior of the building, which is now familiar to the public, is characterized by strength, solidity and extreme simplicity. The same qualities are predominant throughout the interior and make the new home for the house of J. P. Morgan & Company a building unique in the history of commercial structures.

VI. ENGINEERING FOR ARCHITECTS

BY DeWITT CLINTON POND

Mr. Pond has charge of the practical course in structural design at Columbia University. He is extremely successful in instructing men who have had little knowledge of mathematics, and these articles have been written with that in view.

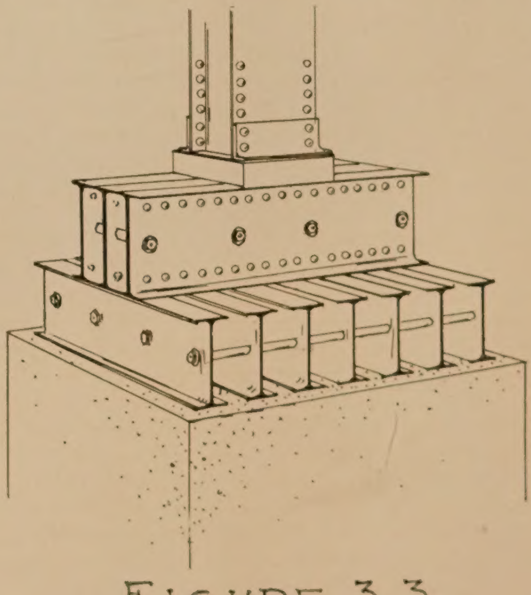
THE subject of grillage foundations embraces theoretical and practical considerations too numerous to be discussed within the limits of a single article. The best that can be done is to give a general description of this type of foundation and to show how engineers dispose of some of the conditions involved in its design.

The Gothic builders first worked on the principle of concentrating the weight of their edifices upon isolated supports. By means of balancing thrust with counter-thrust the weights of vaults, roofs, and walls were transferred to large piers, and the piers carried the loads to the masonry footings. In modern buildings steel columns serve the same purpose as the isolated piers, and the problem of foundation design arises in distributing the loads, brought to the footings, over an area, large enough so that the weight per square foot will not exceed the bearing value of the soil or concrete.

The average steel column is never much more than a foot and a half square, and carries from 300 to 500 tons. A square foot of reinforced concrete has a unit bearing value of 35 tons, and soil can only support 4 tons per square foot. It can be seen from this that a load brought to the foundation by two and a quarter square feet of column, must be distributed over many more square feet of concrete or soil, or the footing will not bear up under the load. Grillage beams are used for this purpose of distribution.

Fig. 33 shows a perspective view of a grillage foundation. Under the column is a steel slab 17 inches wide, 3 inches thick and one foot ten inches long. Under this are placed six 15-inch channels, arranged back to back in three pairs, and under the channels are placed seven I-beams which distribute the 500-ton load over the reinforced concrete.

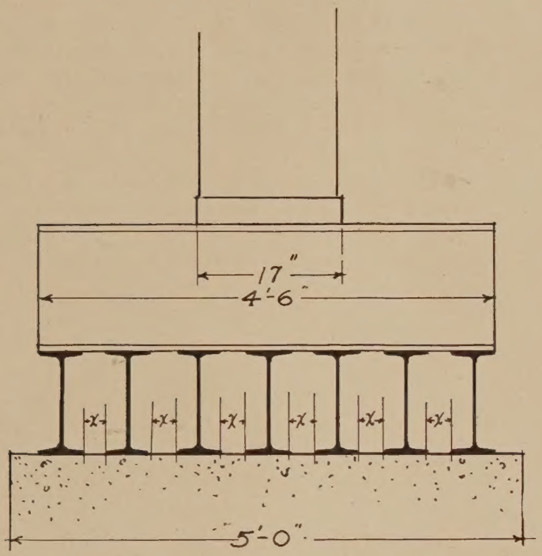
In all previous articles, the only method used in determining the sizes of beams to withstand certain loads was to supply a beam strong enough to resist the tendency to fail by bending. Although it is always necessary to check



FIGVRE 33

the sizes of grillage beams, to determine their ability to resist bending, other considerations, such as crushing of the web, govern the design.

As in the case of column design, it is necessary to make trials in order to determine the actual sizes of the grillage beams, and the general dimensions of the footings. The dimensions of the slab are governed by those of the column.



FIGVRE 34.

A column, made of 12-inch channels and 16-inch plates, with 4-inch by 6-inch clip angles, requires a plate 17 inches wide by 1 foot 10 inches long. The method of determining the thickness of the plate will be taken up later.

When the foundations rest upon bed rock, the outside dimensions of the footing are governed by the bearing power of the reinforced concrete. The New York Building Department allows a pressure of one quarter of a ton (500 lbs.) per square inch on that reinforced concrete which is in *direct contact* with the steel. In other words, the portion of concrete included between the flanges of the lower layer of beams (x—Fig. 34) cannot be considered as supporting any portion of the 500 tons. For this reason it is necessary to use a large number of light beams, having comparatively large flanges, instead of a few heavy beams with comparatively small flanges.

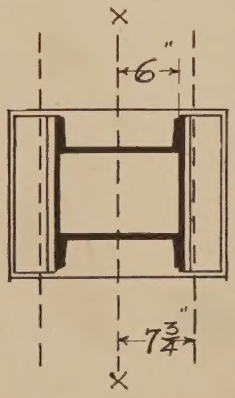
As a trial seven twelve-inch, thirty-five-pound, I-beams will be used in the lower layer of beams. These beams have flanges 5.09 inches wide and a portion of one beam, one foot long, will have an area of $12'' \times 5.09 = 61$ square inches. Seven beams will have $61 \times 7 = 427$ square inches of flange area bearing on the concrete per lineal foot of beam. As each square inch of concrete will support one quarter of a ton, 427 square inches will support $427 \div 4 = 107$ tons. There are 500 tons to be carried so $500 \div 107 = 4.6$ feet of beams will be necessary. To give an even figure these beams will be made four feet, six inches long.

It is usually considered good practice to have the footing square so the upper layer of beams will be made four feet six inches long also. The concrete should project at least 3 inches beyond the ends of the beams, so the outside dimensions of the footing will be five feet by five feet.

We now have assumed the area of the slab and the area of the concrete footing and have assumed the sizes of beams in the lower layer. For the given conditions it is necessary to determine the sizes of beams in the upper layer. These beams will have to withstand a load of 500 tons coming down on 17 inches of their length. On account of the dimensions of the slab there can be only three beams, so each beam will have to support $500 \div 3 = 166.6$ tons. This load will tend to *crush the web* of the beam, and we must supply a beam strong enough to resist this crushing. The number of square inches of steel in the web of each beam under the slab will be given by $17'' \times t$, in which "t" is the thickness of the web. If each square inch will support 8 tons—the safe crushing value of steel—the total bearing value in tons of each web is $17 \times t \times 8$. This, of course, must equal 166.6, or, $17 \times t \times 8 = 166.6$. t must equal $166.6 \div 136 = 1.2$ inches. There is no I-beam having a web as thick as this, so in place of a single I-beam, two 15-inch, 45-pound channels riveted back to back are used, the two webs having a combined thickness of 1.24 inches. The upper tier of beams will then consist of six 15-inch, 45-pound channels, 4 feet, 6 inches long. The only other dimensions to be found in this trial footing is the thickness of the plate.

Fig. 35 shows a plan of the column and plate. The axis XX divides the column into two equal parts and a load of 250 tons is brought down on the right, and an equal one on the left, of this axis. The neutral axis of the right section of the column is assumed to be 6 inches from XX and the load of 250 tons will be concentrated along this line. The centre lines of the beams under the slab are shown by dotted lines 7¾ inches apart. The upward load upon the slab exerted by each beam will be $500 \div 3 = 166.6$ tons. The upward moment will be $166.6 \times 7\frac{3}{4} = 1291$ inch-tons. The downward moment will be $250 \times 6 = 1{,}500$ inch-tons. The difference is $1500 - 1291 = 209$ inch-tons as the bending moment set up in the slab.

Referring to the first article we find that $M = S\ I/c$. $S = 8$ tons, and $I/c = 1/6\ bd^2$. In this case $b = 17$ inches, and the problem arises in determining d. $209 = 8 \times 1/6 \times 17 \times d^2$. $d^2 = 9$, so $d = 3$ inches. This gives us all the dimensions of the trial footing—the size of the plate, the sizes of the beams in the upper and lower layer, and the dimensions of the concrete pier. It is necessary to check the beams, however, to determine their ability to resist bending and shearing stresses.

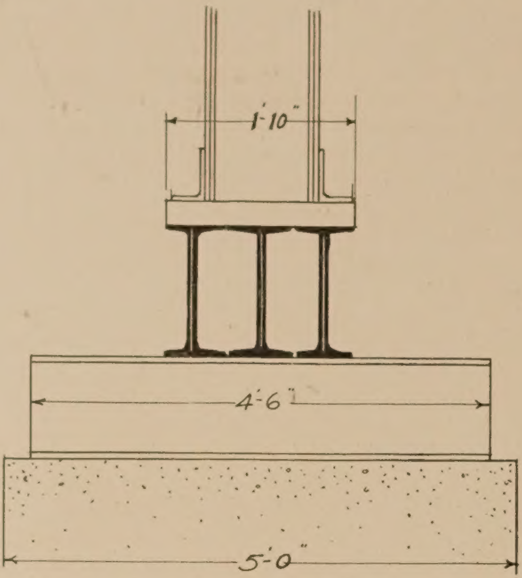


FIGVRE 35

In cases where bending has been considered, the formula $M = \frac{1}{8}\ Wl$ has always been used. A modification of the formula is used in the case of grillage beams. The formula takes the form $M = \frac{1}{8}\ W\ (l - a)$ in which $(l - a)$ is the overhanging length of the beams. In Fig. 34, "a" is the length of the slab or 17 inches, and "l" is the total length of the channels or 4 feet 6 inches. $(l - a)$ equals 4 feet 6 inches minus 1 foot 5 inches or 3 feet and 1 inch.

If $M = \frac{1}{8}\ W\ (l - a)$ then in the case of the upper beams $M = \frac{1}{8} \times 500 \times 3.1 = 194$ foot-tons. The section modulus is found when foot-tons are used by multiplying the maximum bending moment by $1\frac{1}{2}$, as explained in Article

III. 194×3/2=291=I/c. This is the combined I/c for the six channels and each channel will have to have a section modulus equal to or greater than 291÷6=49. This is less than the I/c for a 15-inch, 40-pound channel, which is given as 50, so the channels are safe as far as bending is concerned.



FIGVRE 36

The only other way in which failure can occur is by shearing the ends of the channels off at the edges of the plate. (Fig. 34.) The projection of the channels beyond each side of the plate is approximately 1'-6". This is actually one third of the total length of the channels. If the channels must support 500 tons, each projecting length must support 500÷3=166.6 tons. Each channel will then have a maximum shear of 166.6÷6=27.7 tons. The area of the cross-section of a 15-inch, 45-pound channel is 13.24 square inches, and the shear per square inch on the section is 27.77÷13.24=2 tons, approximately. This is well within the safe shearing value of steel of 4.5 tons per square inch.

We now know that the channels in the upper layer are safe and we must check the sizes of the I-beams in the lower tier. Fig. 36 shows the location of the channels and the slab in relation to the lower beams. "a" in this case is 1 foot 10 inches, and (1—a) must equal 4 feet 6 inches minus 1 foot 10 inches or 2 feet 8 inches. I/c=3/2×⅛×500×2.66=250 for seven beams. 250÷7=35. The I/c for a 12"—I—35 lb. is 38 so these beams will not fail by bending.

These beams might fail by crushing and shearing, however, and it is necessary to determine whether this is the case or not. The projecting ends of the beams beyond the channels are 1 foot 4 inches long and we will be safe in assuming that the total shearing stress is 150 tons. As there are seven beams, the shear per beam will be 150÷7=21.4 tons. The area of the cross section of a 12"—I—35 lb. is 10.29 square inches. To the shear per square inch will be 21.4÷10.29=2 tons approximately which is safe.

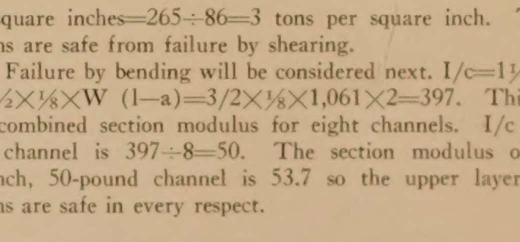
The section of the web of one beam directly under the slab has an area of 22 inches long by .44 inches thick or 9.8 square inches. Seven beams will have a total area of 9.8×7=68.6 square inches. As each square inch will withstand a pressure of 8 tons, 68.6 square inches will support 68.6×8=548.8 tons, so the beams will safely support the 500-ton load.

The trial footing, therefore, is safe in every particular.

The conditions accounted for so far, have been for footings where it was possible to have the concrete rest on bed rock, and where there was no limit to the dimensions of the footing in any direction. This is only one of many conditions that may arise. In case the column is an outside one and placed about two feet back of the building line it would be impossible to have a base 5 feet square. This condition is shown in Fig. 37, and the footing should be longer than it is broad.

In this case the column having a heavy wall load to support will have a load of 1,061 tons. The size of the footing will be considered first. As the column centre line is two feet back of the building line the total width of the footing cannot be more than four feet or forty-eight inches. If five beams are used in the lower tier then there will be four spaces between them, and a slight over-hang on each end, so the beams will be 9" on centres. The average width for heavy flanges is about seven inches so a foot of beam will have 12×7=84 square inches of flange bearing on the concrete, 5 beams will have 420 square inches. Each square inch of concrete will stand one-quarter of a ton so 420÷4=105 tons per foot of beam. 1,061÷105=10 feet. In the trial footing the beams in the upper tier will be taken as 4 feet long, and those in the lower tier will be 10 feet long. The conditions of fabrication will make the slab 24 inches wide by 2 feet 11 inches long.

The next step is to determine the sizes of the beams that make up the footing. The four beams in the upper layer are more apt to fail by crushing than by bending on account of their short length. The slab covers 2 feet of the beam so the thickness of the web must be found as follows: 1,061=24×t×4×8 or t=1061/768=1.4 inches, so, for resistance to crushing, eight 15-inch channels weighing 50 pounds per foot must be used. The shear is one-quarter of the total load as the projecting length of the channels on either side of the slab is one-quarter of the total length. 1,061÷4=265 tons. In this case, because some engineers figure that only the web should resist the shear, we will determine what the shear per square inch on the web of the channels will be. The total area of the web is 8×15×.72=86 square inches=265÷86=3 tons per square inch. The beams are safe from failure by shearing.



FIGVRE 37

Failure by bending will be considered next. I/c=1½M =1½×⅛×W (1—a)=3/2×⅛×1,061×2=397. This is the combined section modulus for eight channels. I/c for one channel is 397÷8=50. The section modulus of a 15-inch, 50-pound channel is 53.7 so the upper layer of beams are safe in every respect.

It would seem that the long beams in the lower tier would have a tendency to fail by bending. (l—a) in this case equals 10 feet minus 3 feet, or 7 feet. The total I/c will equal $3/2\times\frac{1}{8}\times1{,}061\times7=1{,}393$. The section modulus for each beam is $1{,}393\div5=278$.

There is no standard beam that is heavy enough to withstand this bending, so a heavy beam reinforced with plates on the top and bottom flanges will be necessary. In case 24-inch, 100-pound I-beams are used, these plates will be one inch thick. The method of determining this thickness will be taken up in a later article. To resist crushing the web must have a thickness $1{,}061\div36\times5\times8=.73$ and the web of a 24-inch, 100-pound beam will be large enough. These beams should also be checked for shear but, as we have encountered no tendency toward failure in this direction, it can be assumed that there is none in this case.

When columns rest on soil foundations other problems arise, and, when the dimensions of the footing are limited in two directions, as in the case of a corner column, still further considerations have to be taken care of. These complications will be dealt with in the next article.

THE PHILOSOPHY OF COLOR

BY GEORGE H. MORTON

Color is largely concerned with our health. If we surround ourselves with gloomy and dull colors we naturally become downcast and pessimistic.

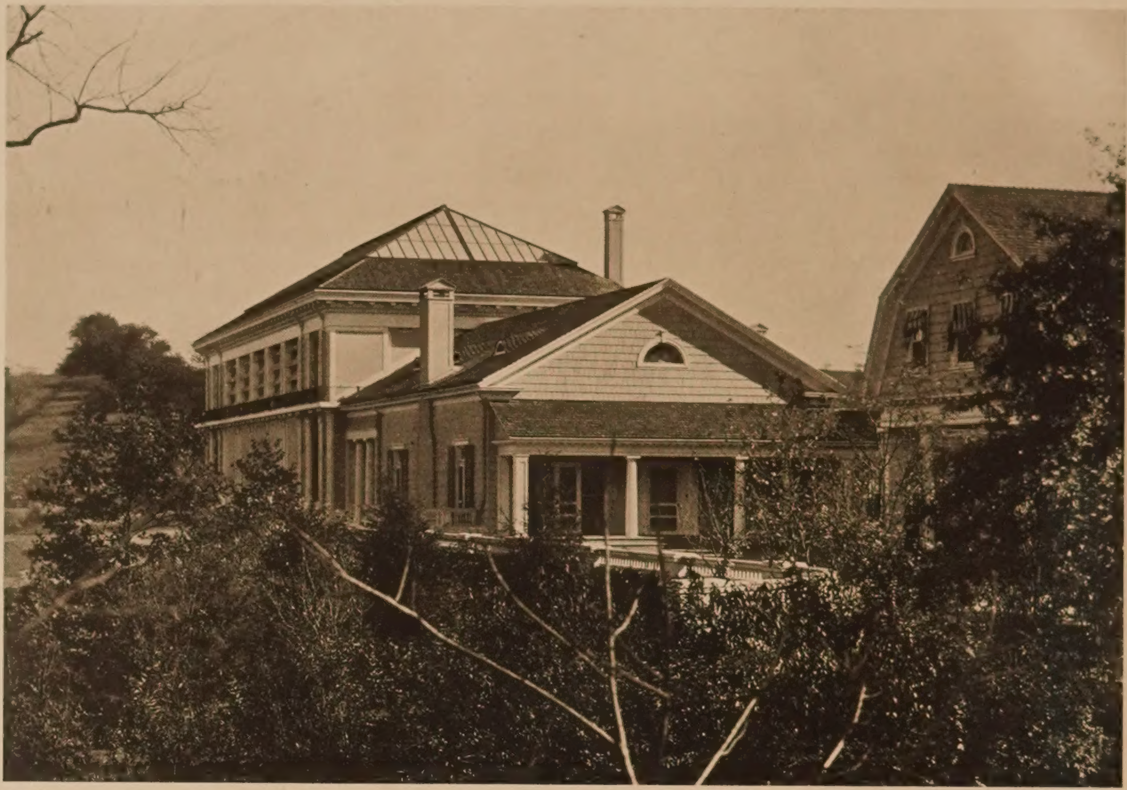
OF all the natural phenomena that affect our senses color is probably the most universally appreciated. Without any perceptible mental or physical effort it discloses to the mind, through the eye, a sense of beauty, and gives us more constant and general pleasure than we experience from perhaps any other sensation. Unlike sound, color is seldom disagreeable, nor does it assert itself in a really disagreeable manner. There is a similarity between the sensations of sound and color—they are often compared. Both are caused by vibrations, not of the same kind, but still vibrations, which affect the mind—sound through the medium of the ear, light and color through the medium of the eye. The majority of the sounds we hear seem to me disagreeable—the noise of traffic, the motor-horn, the steam-whistle, and many other noises are irritating, and were it not that we have become gradually accustomed to them, would be more noticeable and objectionable than they are. At any rate, we are usually glad to get away from them and seek elsewhere for that repose and peace which a modern city seldom affords. Color, on the contrary, though always present, like sound, is generally a gratification. This is pre-eminently the case in the country; but even in the town, though our streets and buildings may become gloomy, they are constantly enlivened by the dresses of women, the sides of vehicles, the shop-windows, advertisement posters, and many other objects reflecting color. In the country and city alike the general effect is harmonious but neutral, for there is seldom much positive strong color present, and when there is, distance lends enchantment to the view. The more brilliant colors are in small quantities, and only appear vivid when near to us; in the country flowers constitute the chief source, and in the town dress, and the other causes to which I have just referred. The present tendency for brighter colors in outdoor dress seems to me justified. Colors which in themselves might be considered aggressive and in questionable taste, add considerably to the brightness of our streets, and are advantageous to the general color effect. Color in outdoor dress until recently seems to have been the monopoly of our Continental neighbors. Color is usually—and, perhaps, exclusively—associated with art; indeed, it would be difficult to imagine art in a general way without it. In recent years, however, it occupies an important and increasing place in science. It is essential to chemistry, to astronomy, to psychology, to physiology—at any rate, so far as the eye is concerned—and forms part of the science of physics itself. Further, it may be considered entirely from the scientific side as the science of chromatics. To consider and study the various phenomena, to ascertain the relations between the æsthetic, scientific, and other facts and ideas concerning color, instead of accepting it in the haphazard manner we generally do, constitutes in my mind a Philosophy of Color. The more we study color the more do we desire to trace out those laws concerning it, recognizing the fact that color, like other sensations which we experience, is governed by definite connections of fixed order and uniformity. From these facts and phenomena we form conceptions and ideas of a reasonable kind, and comparing the relations existing between them, obtain a clearer understanding and a wider and truer knowledge of the real value of color.

The appreciation of color is not a modern conception. It has been peculiar, not only to most civilizations, but to barbarous people though with the uncivilized it was commonly used in a crude and primitive manner. Even with so great a civilization as the Ancient Egyptians, and most Oriental races, the number of colors employed were few; they were generally confined to the three primary pigment colors—red, yellow and blue. With the Egyptians these colors were applied to fill in spaces already outlined. There was no light and shade or graduation of color. The effect was monotonous and severe, exhibiting a crude harmony in which delicacy and charm were neglected, if not entirely absent. Owing to the crudeness of the colors of the Egyptians and contemporary races, it can easily be imagined that the hard color effects of that period were not altogether compatible with the refinement of the Greeks, whose idea of beauty was largely concentrated on form, symmetry, and proportion. This conception was realized to a great extent, and with a delicacy of perception never before appreciated, and which no modern civilization has attained, or is likely to attain, unless social and other conditions alter considerably. Color, though subservient to form, was by no means absent from Greek art. In Pausanius and Pliny accounts of the Greek paintings are most minutely described. From these descriptions one might imagine that there never had been anything so beautiful. The only examples, however, of Greek colors that survive are the terra cotta vases, the colors of which are largely due to, and naturally result from, the material employed in the making. All the paintings have perished, not a single shred remains; but, from the descriptions, paintings of very considerable magnificence adorned the Greek buildings, and the sculptured ornaments and mouldings were defined by color. The colors used by the Greeks were deficient in variety, and, like those of the Egyptians, were few. Pliny tells us that they consisted only of red and yellow—probably gold—with white and black. Unlike the Egyptians' colors, they were more sparingly and subtly employed. The Greeks seemed to have used color—as we might imagine they would do—to define and emphasize that beauty of form the perfection of which was their one great aim. To give a clear outline, and at the same time produce that mellowing and softening effect which the judicious use of color is capable of attaining, and thus combine various details into one harmonious whole. Color, therefore, to the Greeks was of secondary importance in its application, but of general importance in creating a refined bloom over a whole scheme, producing a sort of atmosphere which enhanced the general effect. In the Greek temple it is everywhere apparent that the object was to attain a perfection worthy of the gods. In the Roman temple the aim seems to have been self-glorification. The lavishness of the Romans naturally revived brilliant colors; but they, like their predecessors, used few colors. The brilliancy of the color decorations unearthed at Pompeii and Herculaneum testify to the extraordinary permanence of the pigments employed; but are practically limited to the three primary colors. These decorations, done by Greek artists, give evidence of the excellence of the work; they indicate a freedom of style and a command of the brush entirely absent from earlier work. In the examples that survive there is an almost perfect harmony of color, though as time went on splendor and grandeur of effect resulted in a gaudiness of color, rather than intrinsic beauty. The charm of Oriental colors is well known; but they, again, seem to be confined to the primary trinity of red, yellow and blue, with black and white. These simple colors were not mixed together, so as to obtain compound colors, but were so balanced that when viewed at a distance they appeared blended, and presented a neutralized bloom. In the result obtained the predominating color asserted itself, and gave the hue to the otherwise colorless effect. It was only on a nearer inspection that the brilliance and freshness of the colors became apparent. The Arabs and the Moors obtained magnificent effects in this way. At Cairo the dome of one of the mosques appears colored a soft green tone, remarkable for its freshness, considering that no direct light shines upon it. On a near inspection it is found that instead of being painted one even tone, it is dotted all over with purple and yellow spots on a white ground, leaving parts of this ground exposed. Distance causes these colors to blend and produce a most beautiful tone, impossible to obtain by pigment mixture. But the most remarkable effect of the color is that it is not stationary; its hue seems to change as we look upon it, varying from a bluish to a yellowish green. This extraordinary impression may be explained by the fact that the vibrations of light which excite the sensation of yellow being stronger than those that excite violet, the two colors do not affect the eye simultaneously, hence they are each asserting and reasserting themselves, and cause a sort of movement which, as compared with one dull, even tint, might, I think, be fitly termed living color. We experience similar effects in paintings from nature. Take a white cottage, for instance, in sunlight. It is not like a sheet of white paper, but owing to its rough surface and the construction of our eyes, is reflecting all sorts of prismatic tints, so that in painting we have to use broken color of every conceivable hue to obtain a natural and realistic effect. The Impressionist school appreciates the value of this method of combining colors in the highest degree, producing luminous effects, with, as Mr. Ruskin describes, "not only light in the sky, but light from it." As regards early Christian art, Byzantine and Gothic, we still find that the colors employed almost entirely consisted of the three primary pigment colors, similar to those used by the Orientals, but different as regards design, and symbolic of Christianity. It was not until the Renaissance that an enlarged appreciation of color was apparent, and even in the works of the great painters of that time a preference for the purer primary colors is observable, especially in giving prominence to the principal point of a subject. Whether this limitation of the color-sense to practically three primary colors was due to the inability to see or discriminate the more subtle of complex colors which we are now able to distinguish, or whether these early colorists never thought of combining or mixing colors together it is difficult to determine. It may have been that the eye was at fault and was unable to combine colors, that the three sets of nerves responding to three colors acted independently, in which case all compound colors would necessarily be impossible. Whatever was the explanation, the fact remains that the colors appreciated and employed from the most ancient times were few—seldom more than three—with white and black. It seems probable that the ancients could only distinguish the strongest contrasts, similarly to the child, or the savage, of today, whose ideas of color correspond with his conception of music, which amounts to little more than the beating of a drum to an accompanying chant on one note.

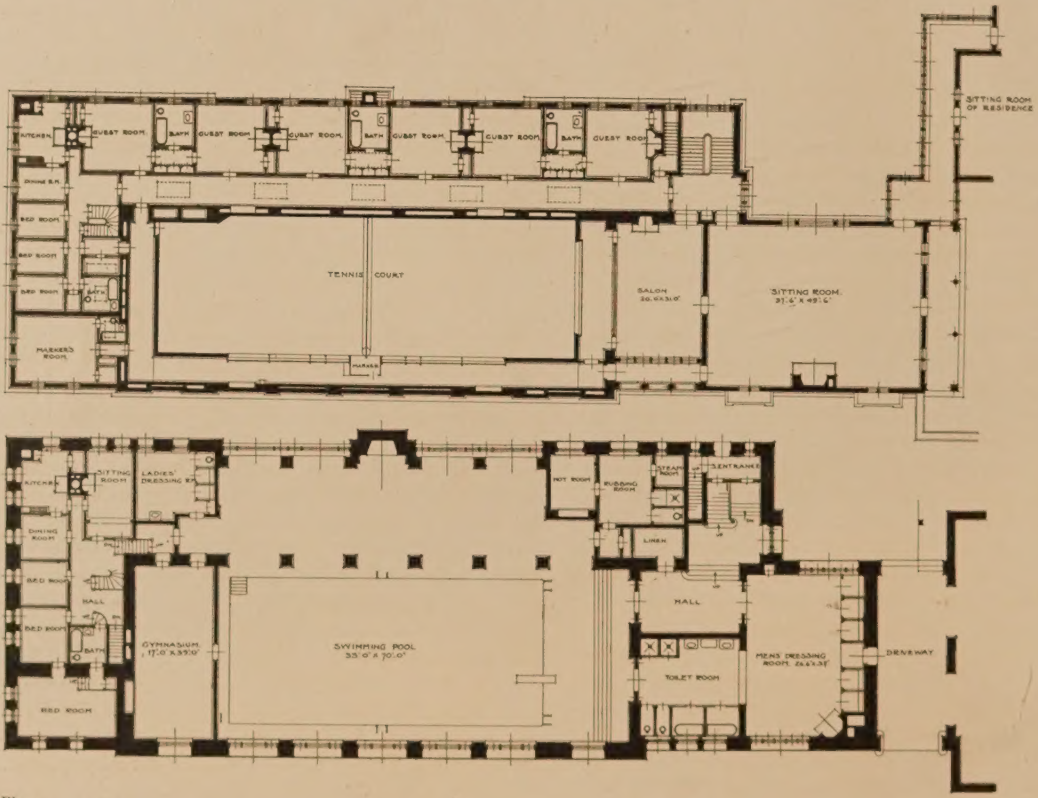
It has been suggested that in remote ages people did not see colors at all, but that the color-sense has gradually developed. From this period of no sense of color, recognition of some three strong, clearly-defined elementary colors gradually evolved, followed by the appreciation of the almost unlimited range of tones, shades, and hues which we are able to distinguish today, for it has been estimated that the eye can now discriminate not less than three million distinct tints, and can tell the 360th part of white added to any color. There can be no doubt that the color-sense has gradually developed, and there probably was a time when color was unperceived and practically did not exist. It has been argued that modern color-blindness is the reversion to that state when all were color-blind. Total color-blindness is comparatively rare, but partial color-blindness is much more common than is generally supposed. The partial color-blind are often unaware of the defect, and, naturally, resent any suggestion of it. It has been estimated that one person out of every eighteen has an imperfect color-sense, though the defect is almost exclusively confined to the male sex. Women are seldom color-blind, and, generally speaking, have a keener color-perception than men and derive more pleasure from it. Partial color-blindness may account for the different names given by different individuals to the same colors. At any rate, it seems to prove that we do not all see colors exactly alike, or are excited by them in the same manner or degree. Blue, for instance, is often named green or purple. The term red to some people indicates almost an orange, to others a warm purple. Any slight difference in the nerves of the retina that respond to color would account for this variability of the color-sense. The different notions people have, however, concerning the names of colors may be due to another cause—the relativeness of color. The hue of a color depends on the other colors with which it is associated or placed in juxtaposition. A color always appears tinged with the hue of the complementary of the contiguous color. Thus any color placed next green would appear of quite a different hue when next red. For instance, gray next red appears pale green, but next green has a pale pink hue. Blue next purple presents a greenish hue, next yellow it assumes an almost purple hue. The different ideas as to the names of a color are, therefore, hardly avoidable in a subject of so relative a character and of such chameleon-like properties. Ignorance of color terms may also explain the inability of some persons to name a color correctly. It used to be a method of testing people whose occupations necessitated an exact or normal color sense to require them to name particular colors, and it was often concluded erroneously that those unable to do so, or who named them incorrectly, were, at least partially, if not altogether, blind to color. The defect in many cases was found to be, not in the eye, but in an ignorance of the color terms—not knowing the names of the particular color shown. The method generally adopted now is, I believe, to mix together a number of various colored wools and require the persons being tested to sort them out and place each individual skein together. The mistakes made by the partial color-blind are often very remarkable and variable. Persons affected with color-blindness are usually insensible to red, though there are cases when other colors are invisible, and red predominates. Color-blindness may be caused by a long exposure to one strong color. It is recorded that some observers, in order to test the effect of one strong color upon the eye, wore spectacles of ruby-colored glass for several hours. This prolonged action of the red light upon the eye finally, to a considerable extent, tired out and destroyed the nerves responding to red vibrations, so that on removing the spectacles only two colors in the spectrum were visible; red was entirely absent, just as in the case of those who are actually blind to that color. All red objects appeared to them to be dull green or brown. That the eye tires of one color though keenly sensitive to another is well known, and as the weariness increases so also does the ratio of a more intense appreciation of its opposite or complementary color. Red, for instance, appears more brilliant and intense when placed in juxtaposition with, or immediately following, its complementary, green. The particular nerves excited by red become wearied by their prolonged effort, while those unaffected, responding to green, are not only able to respond to their particular color, but, in consequence of the action on their wearied fellows, are able to appreciate it to a far higher degree. The effect of any color upon the eye is rendered more vigorous when preceded by its complementary color, more dull or indistinct when accompanied by other similar colors, and more light and dark respectively when in association with deeper or lighter tones. Perhaps the most lasting and agreeable impressions are when colors are attended or followed by their complementary or opposite colors, which, if combined, would produce gray or white; perhaps the least pleasant when one primary or brilliant color is viewed alone for a lengthened period of time. Though no impressions are actually painful of themselves, unless intensely vivid, they may be disagreeable, and, if prolonged, injurious to the eye.

Color, therefore, is not only important in our surroundings, but change in our color environment is essential. In our homes it is not only pleasant and enlivening, but desirable, that the colors in each apartment should be different. If they were each of the same color, and that a strong positive color, our eyes would suffer even to a possibility of partial color-blindness. Were it not for this necessary change of color, particular retinal nerves would be over-excited and strained, to their detriment; but change of color permits the different color-appreciating nerves alternative excitement and rest. When all these nerves are excited simultaneously, as in the case of white, the eye has no rest. The physical desire for change in colors accounts for what is often attributed to mere fashionable caprice. A particular color in decoration of dress is popular, and one frequently hears the question, "What is the new color?" For instance, if purple—or one of its more fanciful and attractive names, heliotrope, amethyst, or violet—is popular for a time, then its complementary, orange, will be the new color and fashionable afterwards. The eye has been satiated with purple, and tires of it; it requires change. The nerves responding to purple are wearied by their prolonged effort, and those excited by orange have rested so long that they desire to assert themselves, and the so-called tango red or orange is the result. It is not so much a question of fashion, but of the natural requirements of the eye. The change I have indicated has actually occurred during the past year or two, and similar changes are continually taking place. Change, however, does not entirely depend upon the substitution of one color for another. We may have the required contrasting color in one scheme—as, for instance, in an apartment where a particular color and its complementary are both present. A scheme of decoration in which the ceiling, instead of being painted the "eternal" white, was colored a tone complementary to the general color of the walls and woodwork, would be eminently satisfactory. This opposite color would not only enhance the beauty of the other colors, but would relieve the eyes whenever they turned toward it. As for instance, a room in which the walls were red and the woodwork dark oak might have the ceiling a dull gray green. A scheme in which the prevailing tones were amber might have the ceiling color a complementary tone of purple. Such schemes would be the more lasting because we have the necessary change or opposite colors constantly in evidence. If change of colors in our surroundings is not provided, Nature seems to force it upon us. We observe, say, a red object for a few moments, then close our eyes; the same form appears, but not the same color; instead we see its complementary or opposite color, green, thus indicating a yearning of the eye for change. The effect of shadows is also remarkable; they are usually tinted with the hue of an opposite color. Our own shadows on a sunny day are a distinct purple, due to a prevalence of so much yellow from the sun. The shadows from a red-brick wall appear tinted green—red's complementary color. A unique example of the value of complementary colors in a scheme, and one that illustrates this point, is the interior of St. Mark's, Venice, probably one of the finest color effects in the world. The walls are of a kind of purply brown marble, and the ceilings mainly gold mosaic. These colors are complementary to each other. The gold gives the marble marvelous purple hues that of itself it does not really possess. The eyes of an observer imperceptibly wandering from ceiling to walls, and from walls to ceiling, are constantly being refreshed—the gold creates the desire for purple, and the

(Continued page 283)



Exterior.



Plans.

TENNIS COURT BUILDING, PAYNE WHITNEY, MANHASSET, L. I.

T. Markoe Robertson, Architect.

(*Continued from page 281*)

purple the desire for gold, so that the beauty of both colors is greatly enhanced, and the eyes never tire.

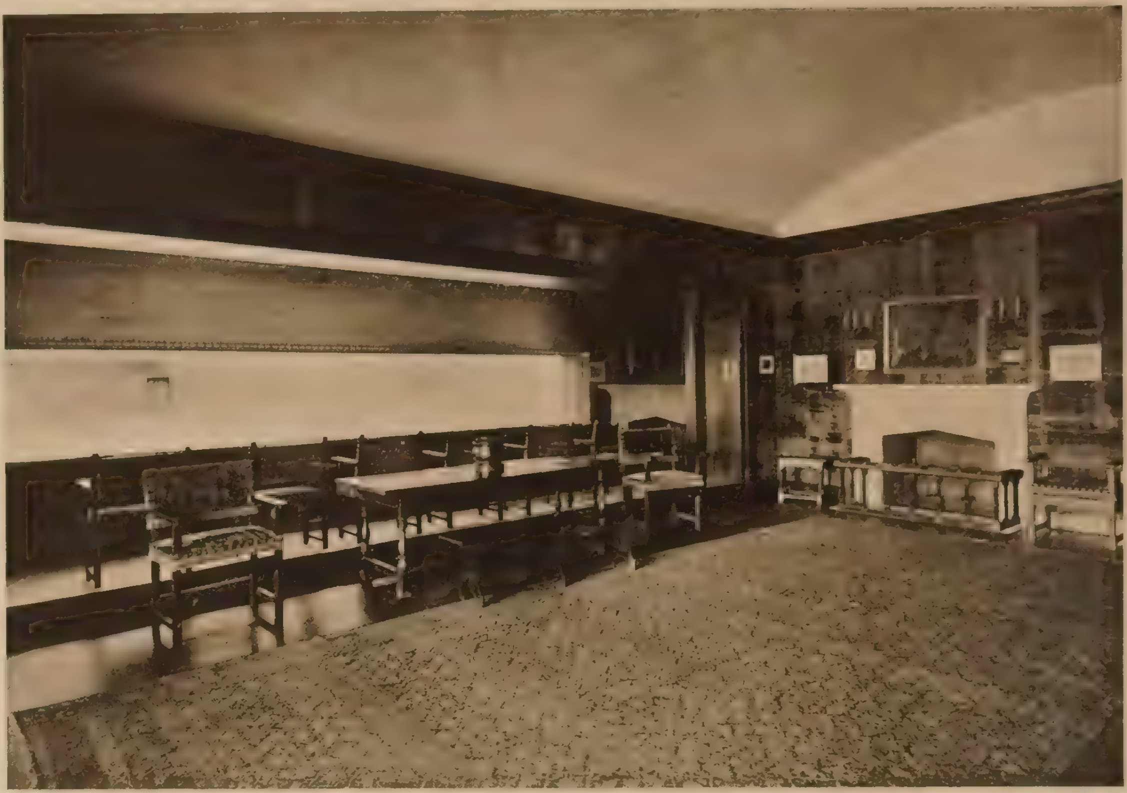
The difference in our ideas of color at different times is an interesting subject. Some thirty years ago William Morris inaugurated a period of dull, dark tones, which was followed by the "greenery-yallery" school. The interior of our homes were made gloomy or sickly by jaundiced tints, producing effects calculated possibly for poetic meditation and study, but hardly in accord with the more sporting, extravagant, and exciting influences now prevalent. The color-sense was hardly excited at all; people lived in a calmer sort of atmosphere, men were more serious, and women affected Mediæval dress and manners. But this was before hotel life and the motor-car came into being, and sport became the all-absorbing topic of interest. These more exciting conditions have consequently brought about a preference for those exciting and brilliant colors abhorred by our forefathers, referred to with scorn by Lady Jane in "Patience" as the "primary colors," and quite incompatible with the "foot-in-the-grave young man" of thirty years ago. Brilliance is essential to sport. The club's university and school colors, the colors at a race meeting all tend to the interest and excitement of the game, and create an enthusiasm that would otherwise be dampened to a very large extent, if not absent. The prevailing colors of an age consequently reflect, as it were, the idiosyncrasies and temperament of the period; but the preference for a particular color also denotes the character of the individual. A person who requires large doses of strong colors before he can appreciate them must necessarily be less refined than he who finds a real æsthetic gratification in subdued and delicate tones. As in music, the people who can enjoy only a catchy music-hall song or a ragtime melody—so called—lack that refinement which a genuine appreciation of a Beethoven sonata or a Wagner overture denotes.

Color is largely concerned with our health. If we surround ourselves with gloomy and dull colors we naturally become gloomy and pessimistic. We have all experienced the depressing effect of the dull, damp weather of winter, and felt how our spirits revive at the first indication of spring and summer. This is largely due to color, the blue sky, the fresh, bright, green leaves, and the colors of flowers. The sensations we appreciate in nature we also appreciate in our indoor surroundings. I am perfectly certain that persons may become melancholy, irritable, and unhappy by the colors they have to endure, and their health suffers as a natural consequence. Some colors excite and irritate, others have a soothing and healing effect. Red and yellow stimulate the physical functions, whereas blue and green have an opposite effect. A person of an anxious, nervous, excitable disposition should avoid certain colors which would be beneficial to anyone of an opposite temperament. It has been found undesirable to place dangerous lunatics in a red room—doing so brings out, or encourages, their violent tendencies. Similarly, to confine a melancholiac in a dull, dark room would possibly increase his morbidness, whereas bright colors and cheerful surroundings would tend to brighten his mind and cure him. It has even been suggested that color accounts for some of our actions, that we are not really to blame for many things we do which we ought not to do, because it is all due to the colors with which we live. A contributor to "Punch" relates that if "instead of going to lawyers" when things run off the rails a bit, we called in a color expert, "all sort of horrors might be avoided," for he would prove that our misdoings were owing to our color environment. "Punch" also tells of a miserly old lady who has a taximeter fixed in her own motor-car, and expects anyone driving with her to pay what it registers, and that color experts say that if it were not for the frightfully dull, dusty purple in which all her rooms are decorated, she might "part quite freely" and be ever so generous.

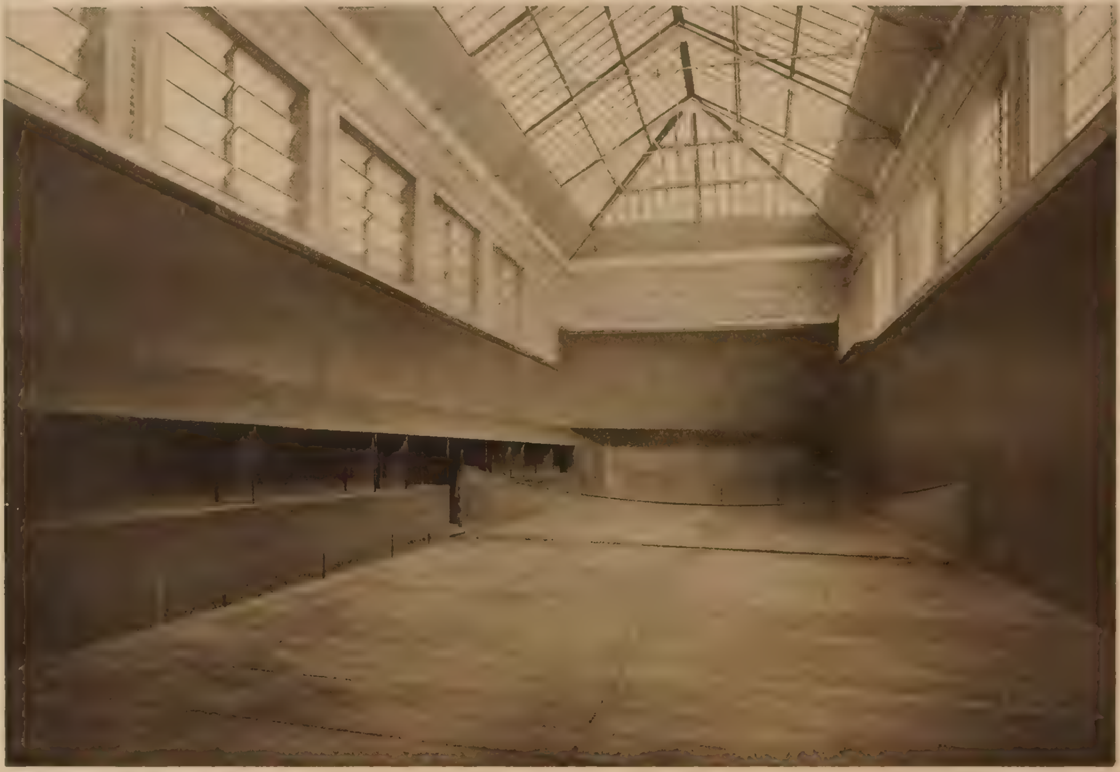
It has been advocated that instead of taking drugs, we should subject ourselves to color influence. Mr. R. Dimsdale Stocker, in a little book called "Color as a Curative Agent," describes the different color remedies and the methods to be followed in applying them. He also points out the effects of different colors on the affections, passions, and other emotions of life. Experiments have been made upon vegetable life with remarkable results. Some plants, under red glass, have grown to four times their normal size; others, under blue and green glass, have perished. It is argued that if such changes take place in the vegetable kingdom the influence of color upon animal life may be considerable. The source of light and color is the sun; its rays give life. Each of these rays, caused by different-lengthed vibrations, represented by different colors, possess definite properties which affect our physical, mental, and moral life. The evil effect of colors upon us may be partially due to dull, dirty shades, to want of a proper harmony or balance of colors, to the contrasts being too strong. A good deal depends on our individual dispositions but it is generally the result of an excessive amount of one color or white. I have told the story before of the lady who, to use her own words, had a great partiality for red—so much so that she had most of her rooms painted in that color. A few months after the work was done she complained of the monotony of it, but still more of the color fading to a dull brown. On my inspecting the work I was struck by the intensity of the red, and on being asked as to the cause of the deterioration or fading replied that to my eyes the color was as bright as it well could be, but that she herself was gradually becoming color-blind to red, due to her eyes being constantly and almost exclusively excited by that one color. Her general health was also affected.

Another personal experience I may relate was the case of a clergyman who had his study walls covered with a bright red wall paper. Calling on him one day, I found him at work in his dining-room. He told me that he always felt uncomfortable in his study, that he became restless, and could not settle to work. I suggested altering the color of his walls to a neutral green; this was done, and peace and serenity were restored to him. A local example of the effect of red may be experienced at the new Adelphi Hotel. The smoke-room there has red walls, red carpet, and red furniture. Most people on entering the room experience a peculiar excitable sensation, and do not seem to remain in it long. I generally find the room empty. What would have been the effect if the ceiling and woodwork had also been red it is unpleasant to contemplate. The absence of color altogether, though not so pernicious as a long exposure of one strong color, is very undesirable. A gray tone may be tolerated, but a pure white is objectionable and injurious to the eyes. One has only to remain in a white tent for some time to experience the effect. Snow-covered land is somewhat analogous. The effect of white upon the eyes of Arctic explorers is well known. Darkened

(*Continued page 289*)



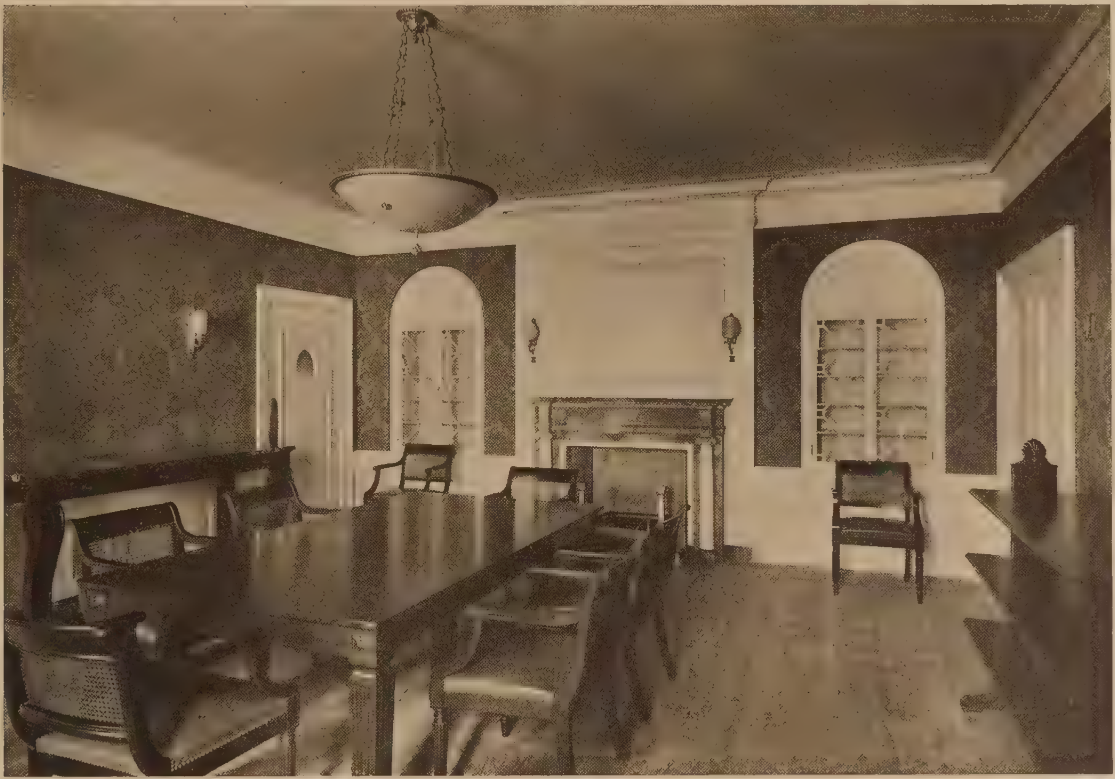
Salon.



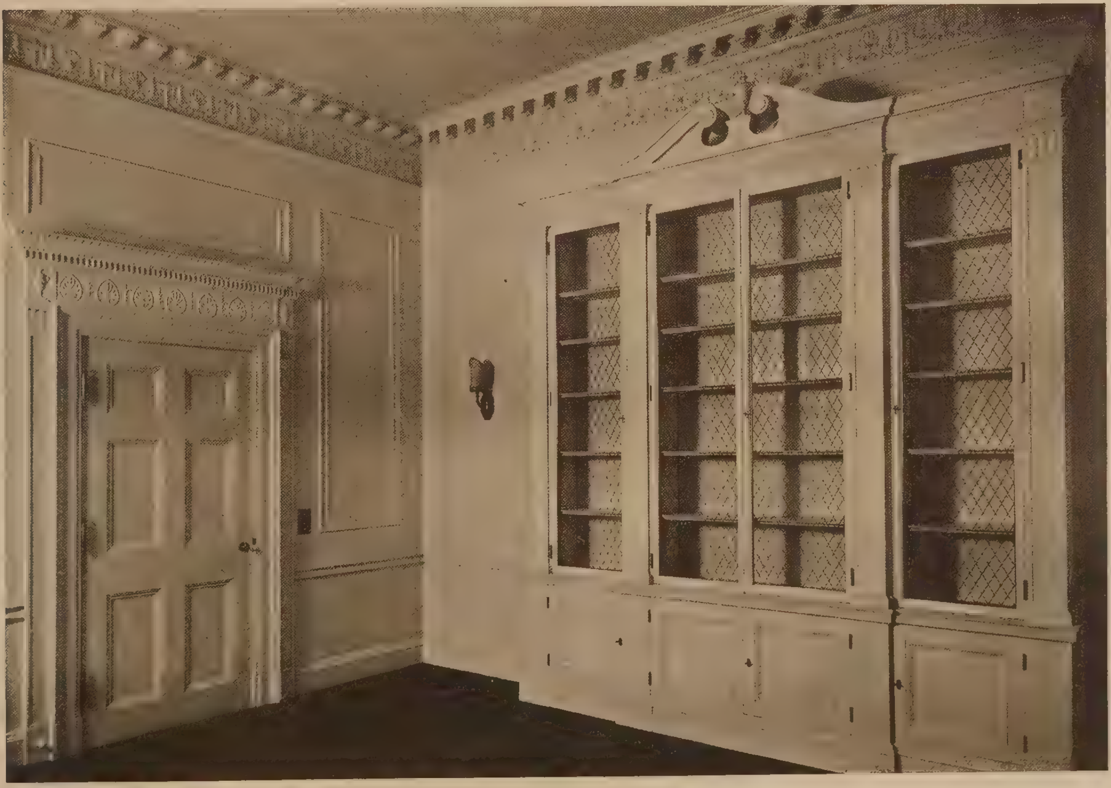
Tennis Court.

TENNIS COURT BUILDING, PAYNE WHITNEY, MANHASSET, L. I.

T. Markoe Robertson, Architect.



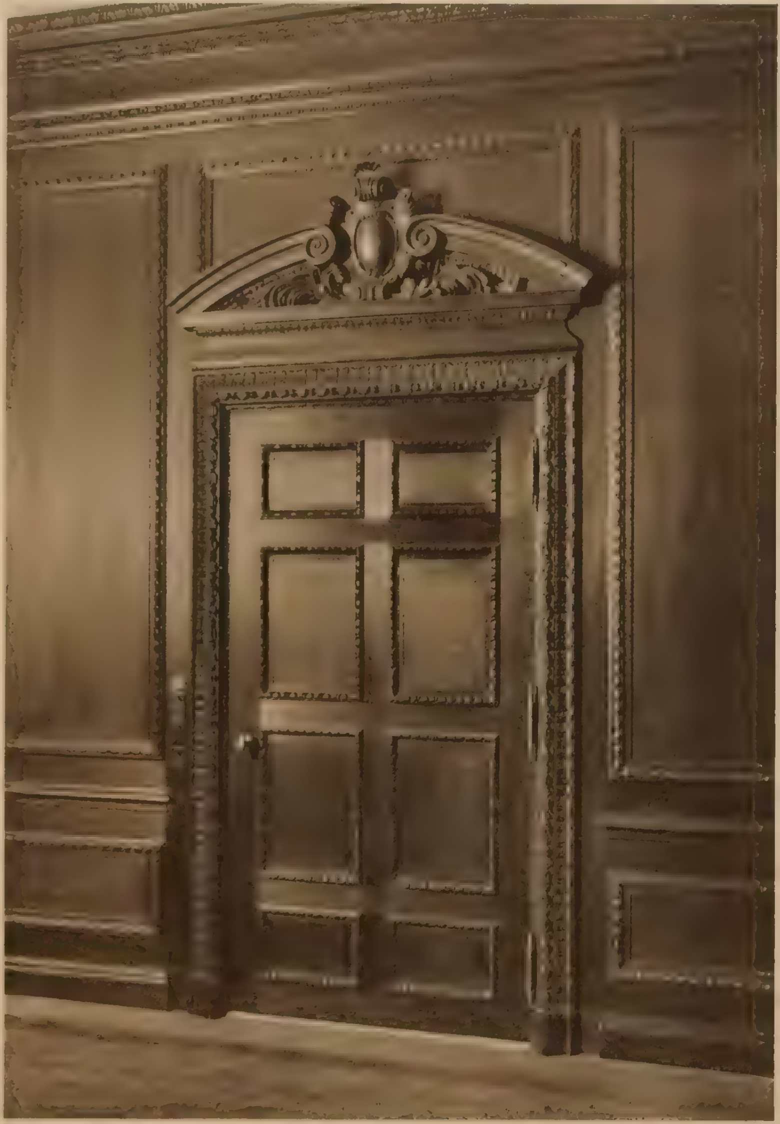
Private Dining Room.



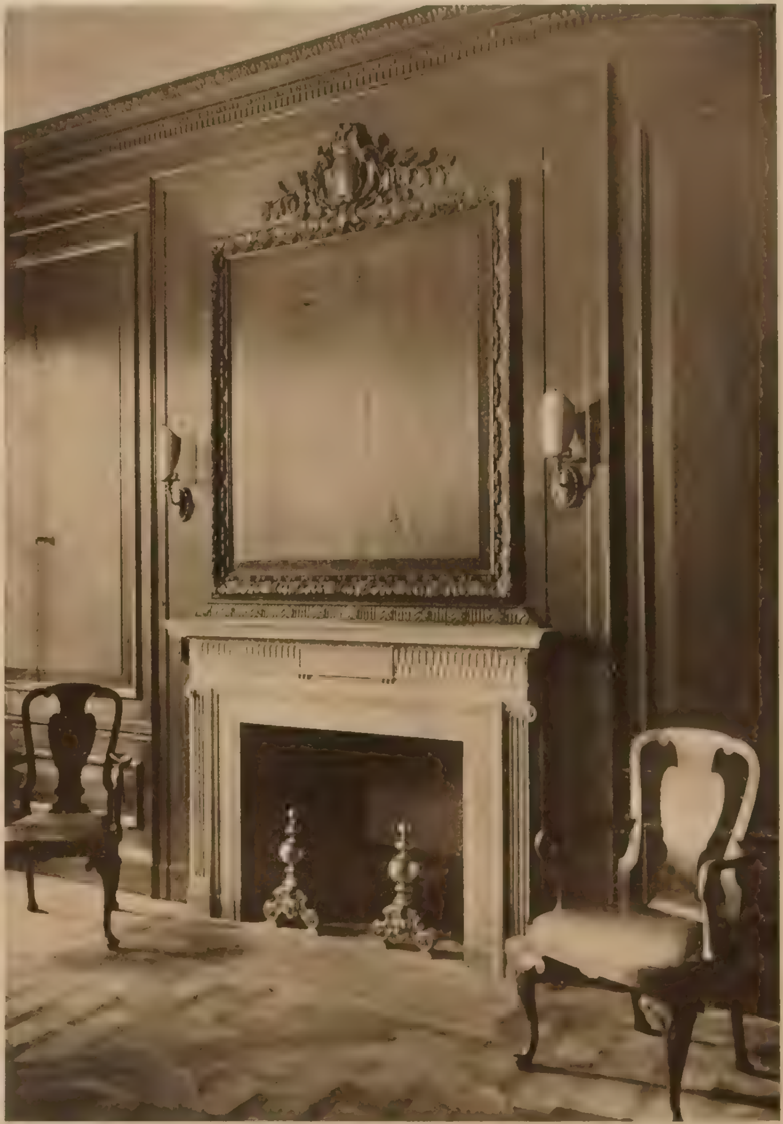
Detail, Partner's Room.

BANKING HOUSE, J. P. MORGAN & CO., NEW YORK.

Trowbridge & Livingston, Architects.



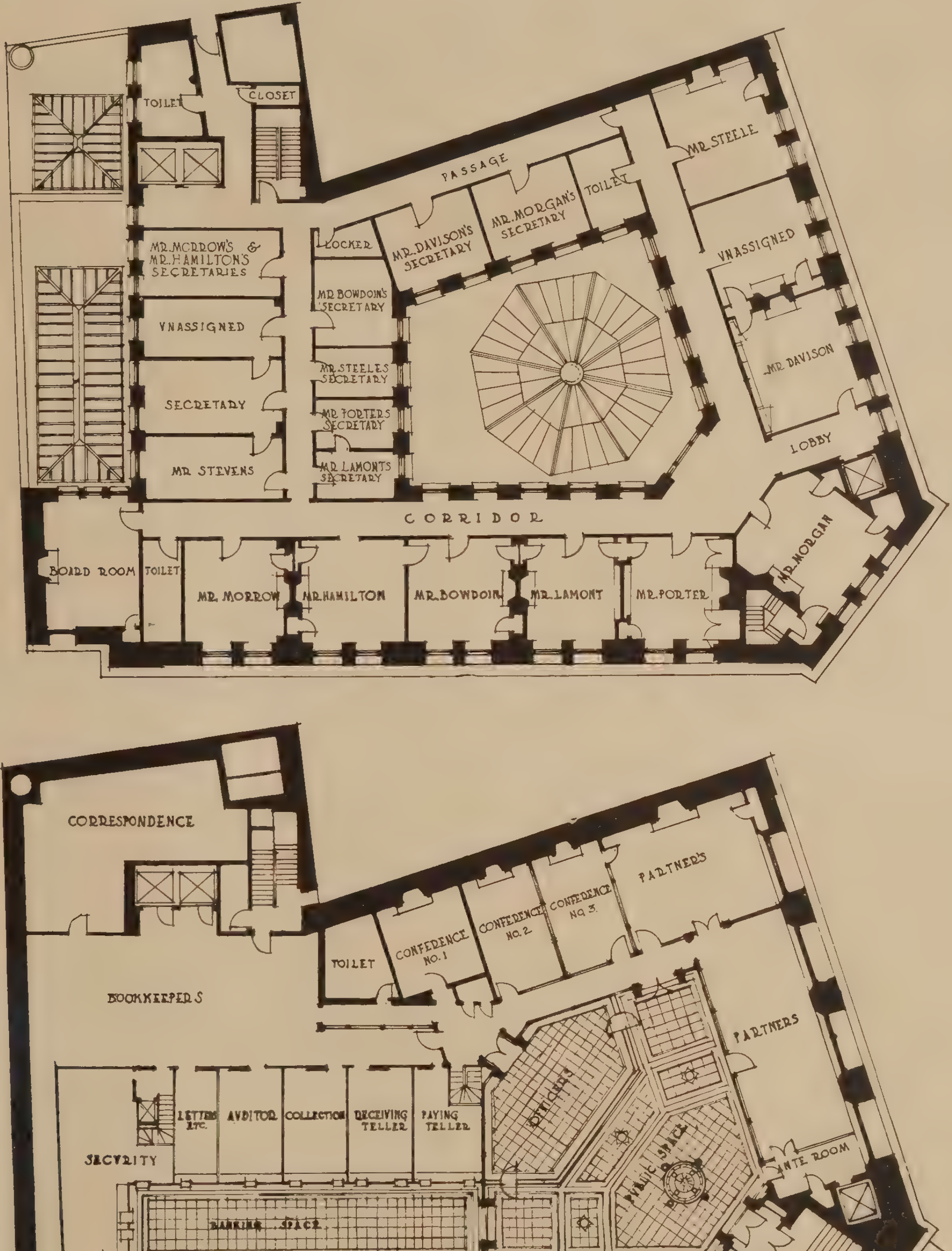
Detail, Private Room, H. P. Davison



Detail, Private Room, W. P. Hamilton.

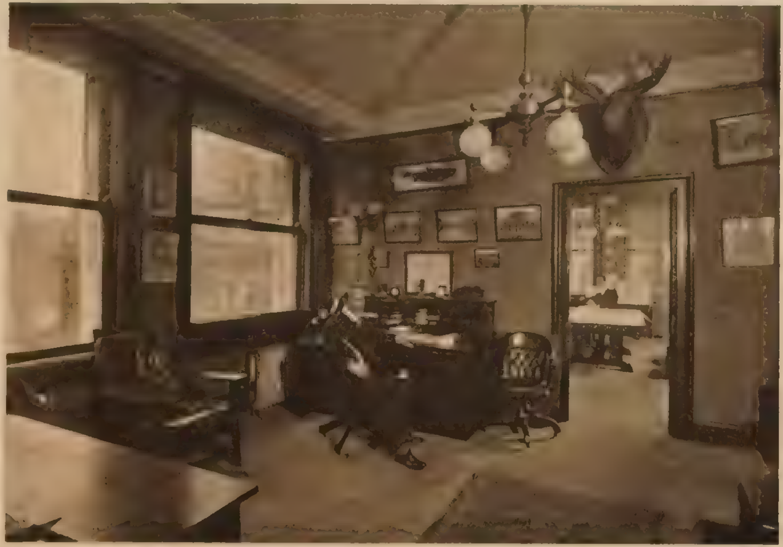
BANKING HOUSE, J. P. MORGAN & CO., NEW YORK.

Trowbridge & Livingston, Architects.

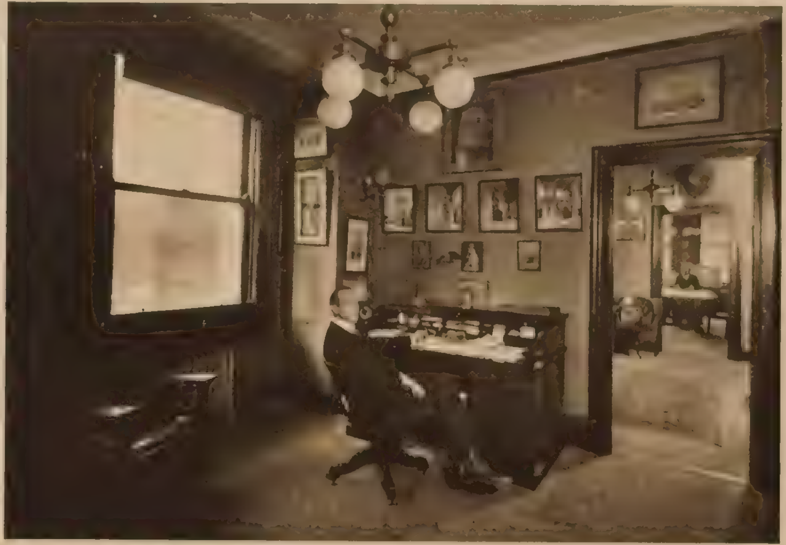


PLANS, BANKING HOUSE, J. P. MORGAN & CO., NEW YORK.

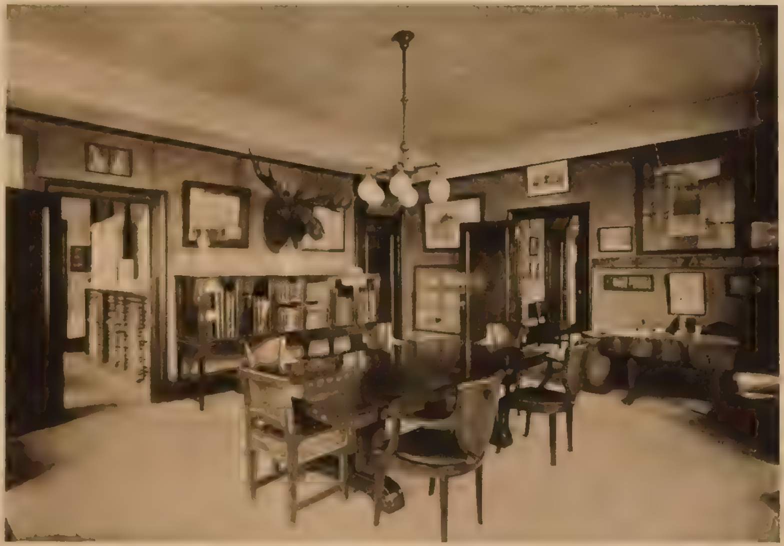
Trowbridge & Livingston, Architects.



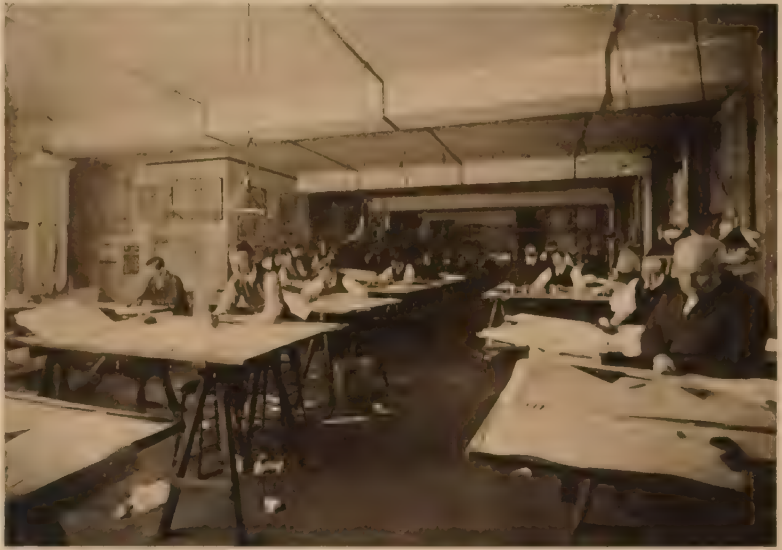
Private Office, Mr. Trowbridge.



Private Office, Mr. Livingston.



Reception Room.



Draughting Room

ARCHITECTURAL OFFICES, TROWBRIDGE & LIVINGSTON, 528 FIFTH AVE., NEW YORK.

(Continued from page 281)

spectacles are worn, not so much on account of the intense cold, but because of the blinding effect of the continuous and unchanging white upon the eyes.

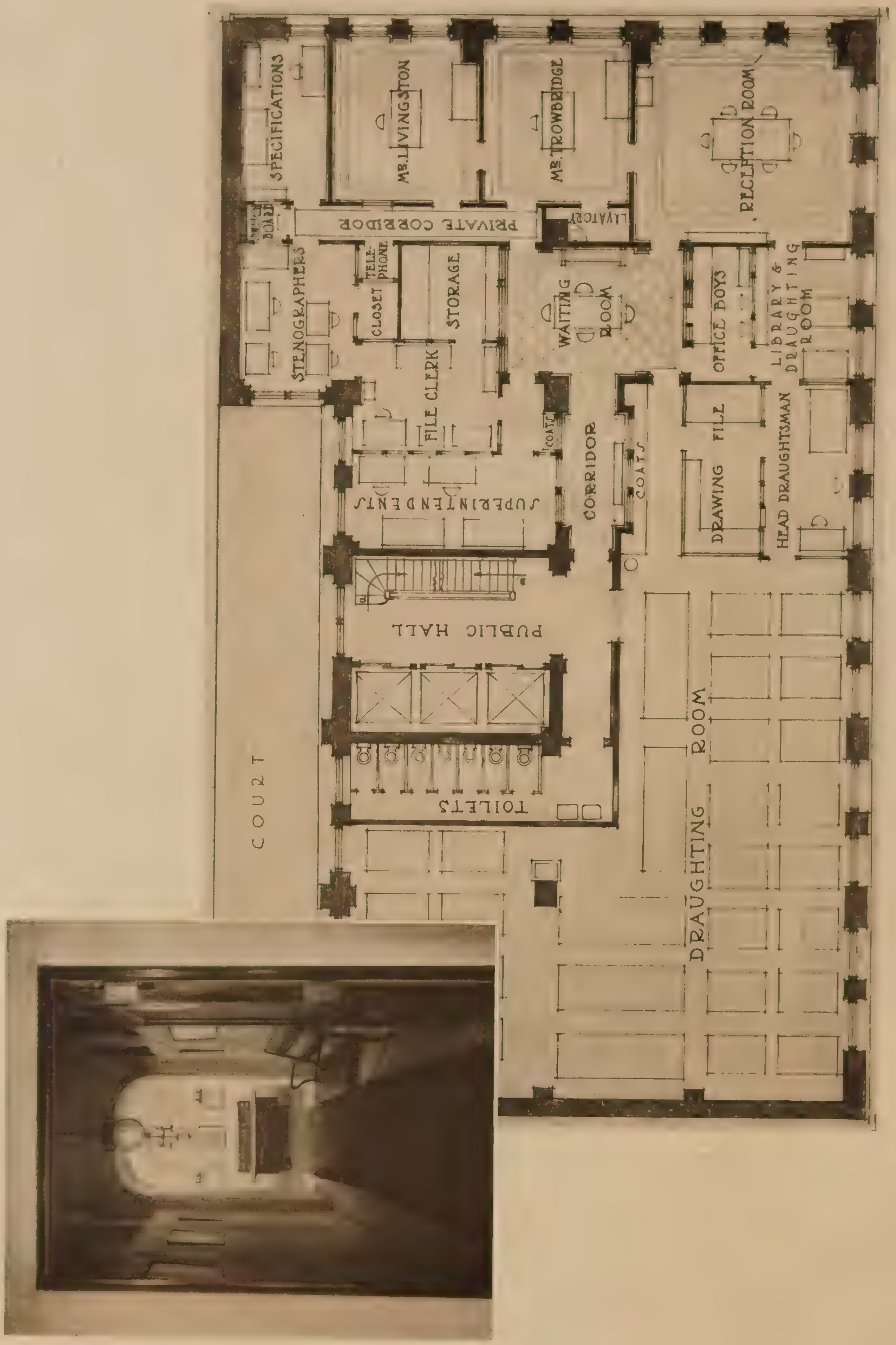
From my preceding remarks it may be concluded that color is not only an æsthetic gratification and a means of distinguishing and defining form, it is a necessary requirement of the eye which suffers when exposed to inharmonious colors, to the sustained action of one strong color, and to light without color. If the eye suffers, the general health will also be affected. This subjective consideration of color, however, is only one side of a two-sided subject. Color has also its objective side. We experience sensations which we call color, but objects in nature cause these sensations. It is well known that colors do not exist outside ourselves, but are caused by vibrations of light upon the retina of the eye. Were it not that the eye is sensitive to colors these different vibrations would be, practically, imperceptible degrees of heat. White light consists of different-lengthed vibrations, each producing a different color sensation, simple or compound; but so long as these vibrations remain united the impression is white. Something then takes place in the light when it shines upon natural objects, or on these objects themselves, in order to separate the different vibrations and produce the various color sensations upon the retina. This something is the power which all natural bodies have of selecting their own particular color, though no natural body actually creates color. It simply absorbs or destroys a part of the white light shed upon it and rejects the remainder. The portion so rejected, and not that retained, determines the particular color.

As regards the eye, Helmholtz has said "that if any optician had sent him an instrument so full of defects he would be justified in sending it back with the severest censure." In spite of so great an authority I feel that of all human instruments it is the one with which we would least willingly part. With one portion of it we are now concerned—the retina, which consists of ten different layers. One of these divisions, the so-called layer of rods and cones, has the power of appreciating the sensations of light and color. The rods and cones seem each to have their peculiar functions, and though both probably serve as, or respond to, elements of light, it is more especially the functions of the rods, whilst the perception of color is due—possibly exclusively—to the cones. These cones seem to consist of three sets of nerves, which respond to certain vibrations of light and produce the sensations of three fundamental, or primary, colors. One set, being stimulated by the strongest vibrations, produces the sensation of an orange red, and another set, being acted upon by vibrations of medium length, produces a brilliant green, and a third set, responding to the short and weaker vibrations, produces the sensation of a violet or purple of a bluer hue than is perhaps commonly understood by that term. All vibrations, however, may, and probably do, act on the three sets of nerves simultaneously; but those that produce red, green, and violet affect most powerfully the particular set of nerves specially designed for their reception. All other colors are due to two or three sets of nerves being excited in varying degrees, either simultaneously or in rapid succession. Upon the three sets of nerves being fully excited in their proper relative proportions the sensation of white is the consequence.

In perfect color combinations or schemes it is essential that the different sets of nerves should be excited, so that no one set will be unduly tired or injured. This is what constitutes the real harmony of color. A scheme which only excites one set of nerves—that is, one color—and thereby creates a desire for another color, or colors, cannot be considered harmonious or satisfactory. We usually speak of colors harmonizing when they match or are similar; but this is not harmony in the strict or more exact sense of the term, which must include the exciting of all the color-appreciating nerves. In a paper that I read before the Philosophical Society some years ago on "Color Harmony" I was taken to task on this point. How was it, I was asked, that a yellow cornfield with red poppies was so harmonious when those colors excited only two sets of nerves—those responding to yellow and red? I replied that they of themselves were not harmonious, and do not constitute the whole of the color visible, the large amount of blue sky must also be recognized and taken into account, which, with the yellow and red of the corn and poppies, presents an almost perfect color harmony, and by which the three senses are excited. Owen Jones in his "Principles of Color," states that no composition can ever be perfect in which any one of the primary colors is wanting, either in its natural state or in combination, and that the various colors of a composition should be so blended that the objects colored, when viewed at a distance, should present a neutralized bloom. Objectively therefore, as well as subjectively, an harmonious scheme of color should include all those colors which are necessary to excite the three color sensations.

As a matter of fact, the impression of one pure color upon the retina, seldom, if ever, occurs. It is generally in conjunction with at least a small mingling of those other colors which would tend to neutralize or deaden its intensity. We probably, therefore, never see colors absolutely pure. Were we to do so, they would be so intense as to dazzle the eye by their brilliancy, and be similar to looking at the blazing sun. Though the excitement of the three primary color sensations is essential to a true color harmony, yet they should not be effected in a crude and elementary manner by pigments or objects reflecting hard contrasts of color, which would be equivalent to three loud harmonious notes as compared with music. The beauty and art of coloring is to get these harmonious impressions in the most subtle and least apparent manner possible. We find that Nature when it develops a color scheme does so by tones of little contrast, using contrasting colors only to accentuate or emphasize points in a scheme, and then only very sparingly. Crude and hard contrasting colors are a sign of primitive man, indicating a lack of development in color appreciation. Almost any butterfly or flower will give us a lesson of the way to obtain color harmony, while the Ancient Egyptians, the present savage, or the child can scarcely be relied upon for good taste in color. The appreciation of this beauty of color harmony is one of the certain indications of refinement and civilization, just as much as the appreciation of harmony in music indicates the same thing in the community and the individual. There are some authorities who hold the opinion that there can be no such thing as color discord. Though not agreeing with this opinion, I consider that any inharmonious combination may be made harmonious without altering any of the colors in question, but by adding another color, or colors, to the scheme, so as to satisfy the requirements of the eye.

(Continued page 291)



ENTRANCE AND PLAN, ARCHITECTURAL OFFICES, TROWBRIDGE & LIVINGSTON, 527 FIFTH AVE., NEW YORK.

(Continued from page 289)

That the million of tints which the eye is capable of distinguishing is due to the excitement of three-color sensations, in varying proportions, seems to me a very wonderful phenomenon. It appears especially attractive because of the difference in the names given to the three primary or fundamental colors by the physicist and the painter. The physicist asserts that the primary colors are red, green and violet, while the painters tell us that they are red, yellow and blue; both the scientist and the painter, however, seem to make the same initial mistake. They use the word "color" as a noun or substantive, whereas, as applied to the primary colors, it acts as an adjective, describing particular sensations on one hand and particular pigments or substances causing those sensations on the other. There is all the difference in the world between a sensation and the object causing it. There is as much difference between a primary color sensation and a primary color pigment as there is in sound between the note we hear and the object causing it, between the music we appreciate and the violin or other musical instrument producing the sensation.

From my remarks it will be concluded that the subject of color is deeper and goes further than a mere attraction of the eye or a simple æsthetic gratification. It has a physical and scientific side which bears much the same relation to color as the laws of sound and acoustics bear to music. It is never stationary for a moment of time because of the movements both in Nature and in the human organ of sight. Color idealizes and adds a charm to all visible things. Its influence is unlimited, for everything that comes within range of vision usually excites a color sensation. In painting it gives to form an interest and an interpretation of Nature impossible to obtain without it. It is color more than anything else that endows a flat surface with the resemblance of reality and nature. It adds a radiance that no mere photographic presentment of a scene can give. It has to do with and affects our health, our temper, our happiness. It indicates and influences our dispositions and characters. As vitiated air injures our health through the lungs, as distracting sounds affect our health through the ear, so bad coloring affects our health through the eye.

Color, therefore, should be studied and considered not only from the æsthetic and scientific sides, but also from the point of view of reason and sense. This consideration of color, to my mind, constitutes its philosophy.

A MODERN ARCHITECTURAL OFFICE

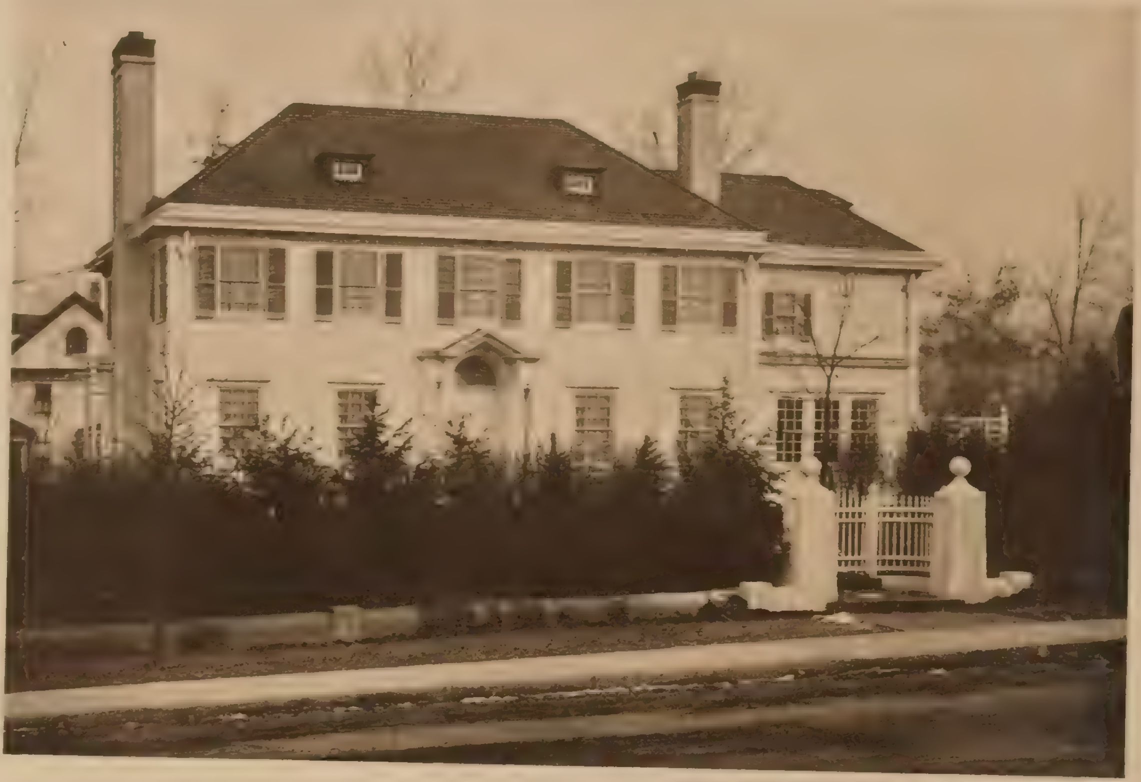
THE efficiency of the modern architectural office depends so largely upon the proper co-ordination of the various departments necessary to the carrying on simultaneously of very large and important undertakings, that the plan and arrangement of offices is a matter of vital importance.

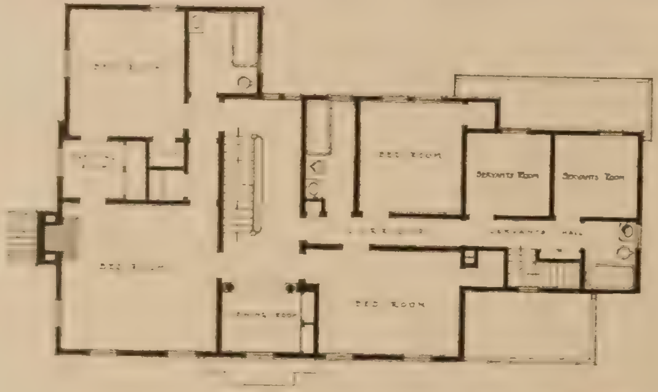
While architecture is essentially a fine art, the complexities of modern construction, the large sums of money disbursed, the new problems in foundations, and the vast increase in mechanical apparatus, have so added to the problems of building to-day that in addition to his artistic training and ability, the architect must not only be thoroughly equipped to care for the financial interests of his clients, but he must also be prepared to solve the many very intricate problems which constantly confront him.

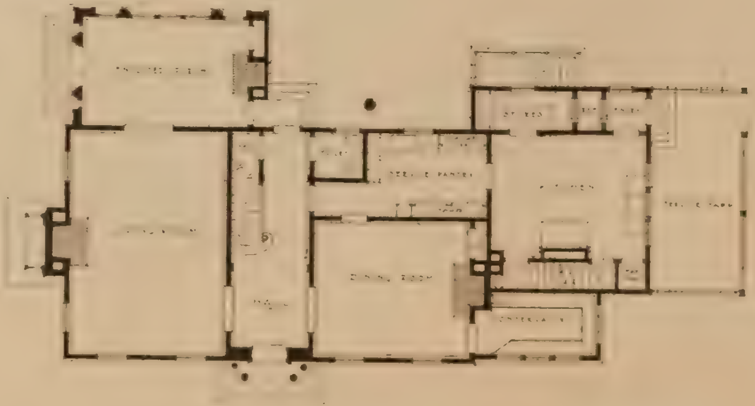
The business of an architect then is two-fold. It comprises on one hand design, and on the other hand administration and construction. Generally speaking, under design are included the making of sketches, scale drawings and full size details; and under administration are included bookkeeping, specifications and contracts. Superintendence is divided between the two. Under design, superintendence includes the supervision and inspection of models, carving and other work in the shops, and inspection at the building; under administration, the inspection of construction work at the shops and at the building. Both forms of superintendence being necessary in order to insure the carrying out of the spirit of the drawings and the terms of the contracts and specifications.

To meet these conditions in the most economical and effective way, the ideal office should be so planned that correspondence between departments governing these different functions should be accomplished automatically, with the least possible friction, and with the possibility of omissions and mistakes reduced to a minimum. The office of Trowbridge & Livingston, which covers the entire fourth floor of the Harriman Building, 527 Fifth Avenue, in its plan, organization and equipment fulfills these conditions. Mr. Trowbridge's and Mr. Livingston's private offices adjoin and are intercommunicating. While both partners consult and decide upon all questions of importance, whether of design or administration, in the ordinary course of business Mr. Trowbridge looks after matters of design, scale and full size drawings, models and inspection. Mr. Livingston has general charge of matters of administration, specification, contracts, superintendence, etc., correspondence being divided according to its relation to the one or the other subject.

Their private offices occupy the center of the front of the floor. Adjoining Mr. Livingston's office are the departments of bookkeeping, specification writing, stenography, filing and superintendence. On the opposite side, next to Mr. Trowbridge's room and connecting with it is the reception room for clients, the library, contractors' room, and the room for issuing drawings. Following in sequence is the room of Mr. Frost, the manager. This room overlooks the draughting room which is a large, well-lighted space, capable of accommodating fifty or sixty draughtsmen and connecting across a passage with the superintendent's room. Thus it will be seen that every design or instruction, whether relating to the smallest moulding or to the largest building, must automatically pass from the source, through each department. To check this, a system of memoranda has been devised by which the record of every interview with clients or with contractors is posted at the head of each division of the office. Superintendents' reports are returned personally to Mr. Trowbridge or to Mr. Livingston according to the subject. There is no duplication of work, no conflict of authority, no friction possible, each partner performing his function independently but with full knowledge of all that proceeds in the office.

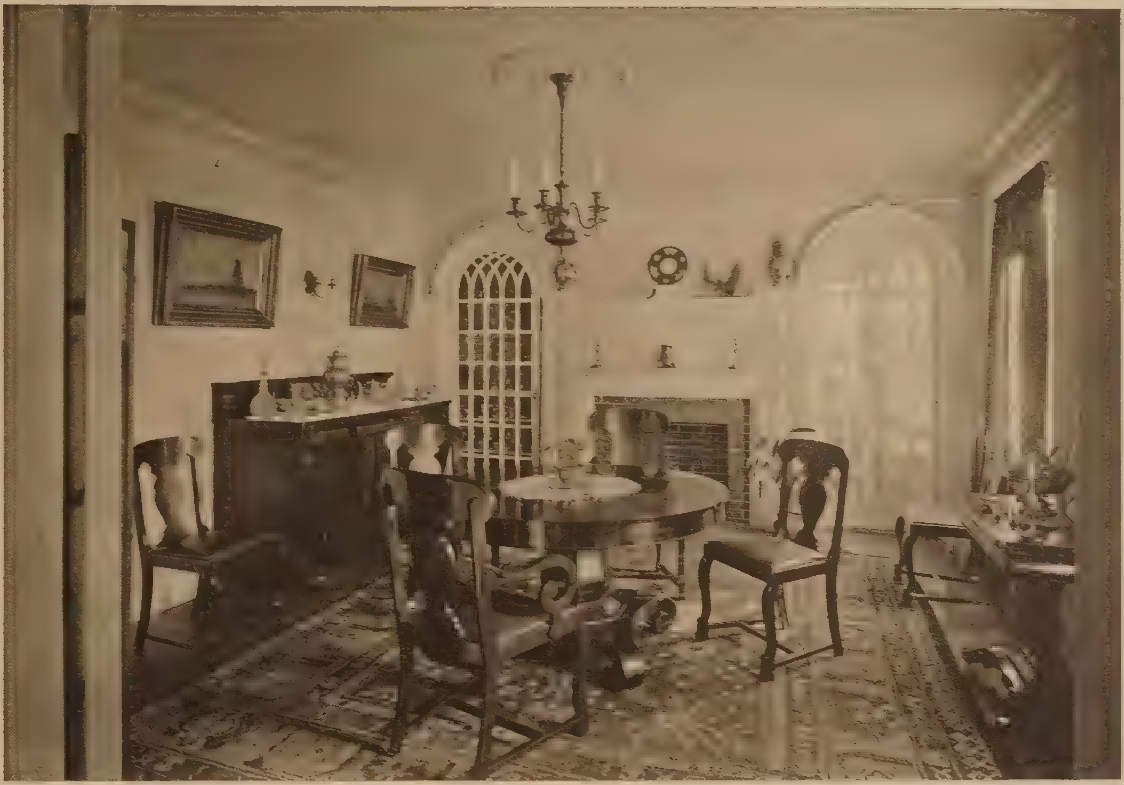




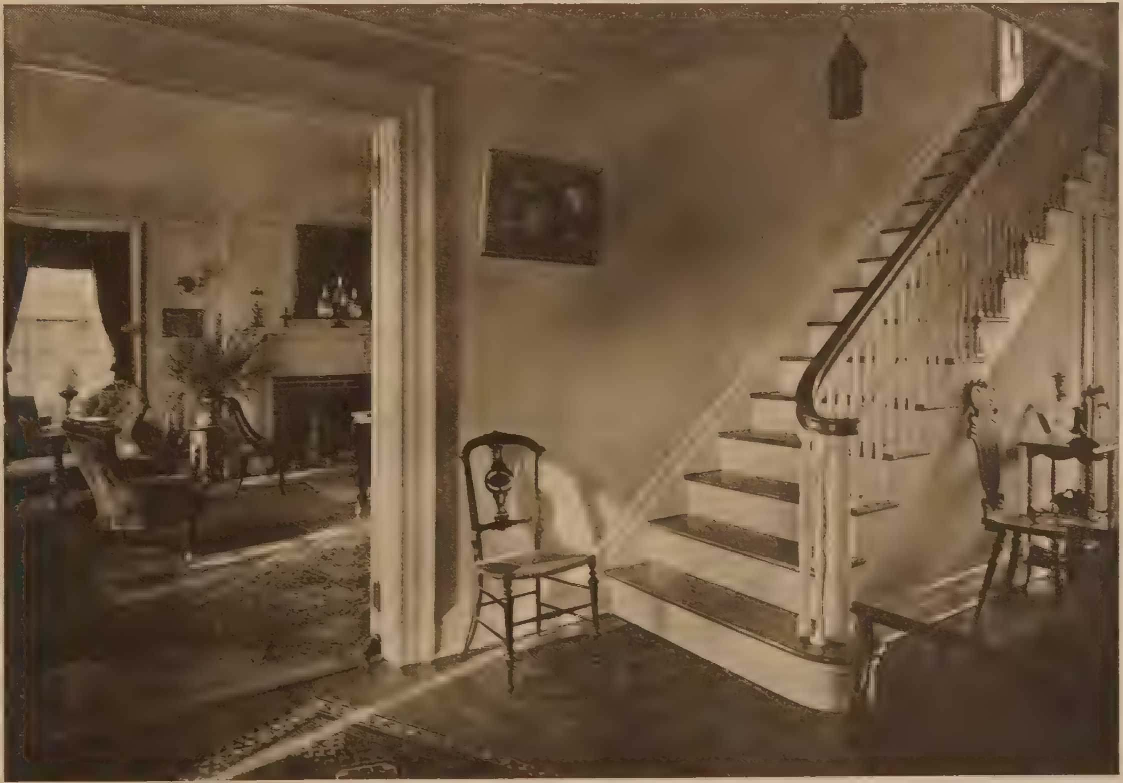


HOUSE AND PLANS, F. H. NORTON, NUTLEY, N. J.

Armstrong & De Gelleke, Architects.



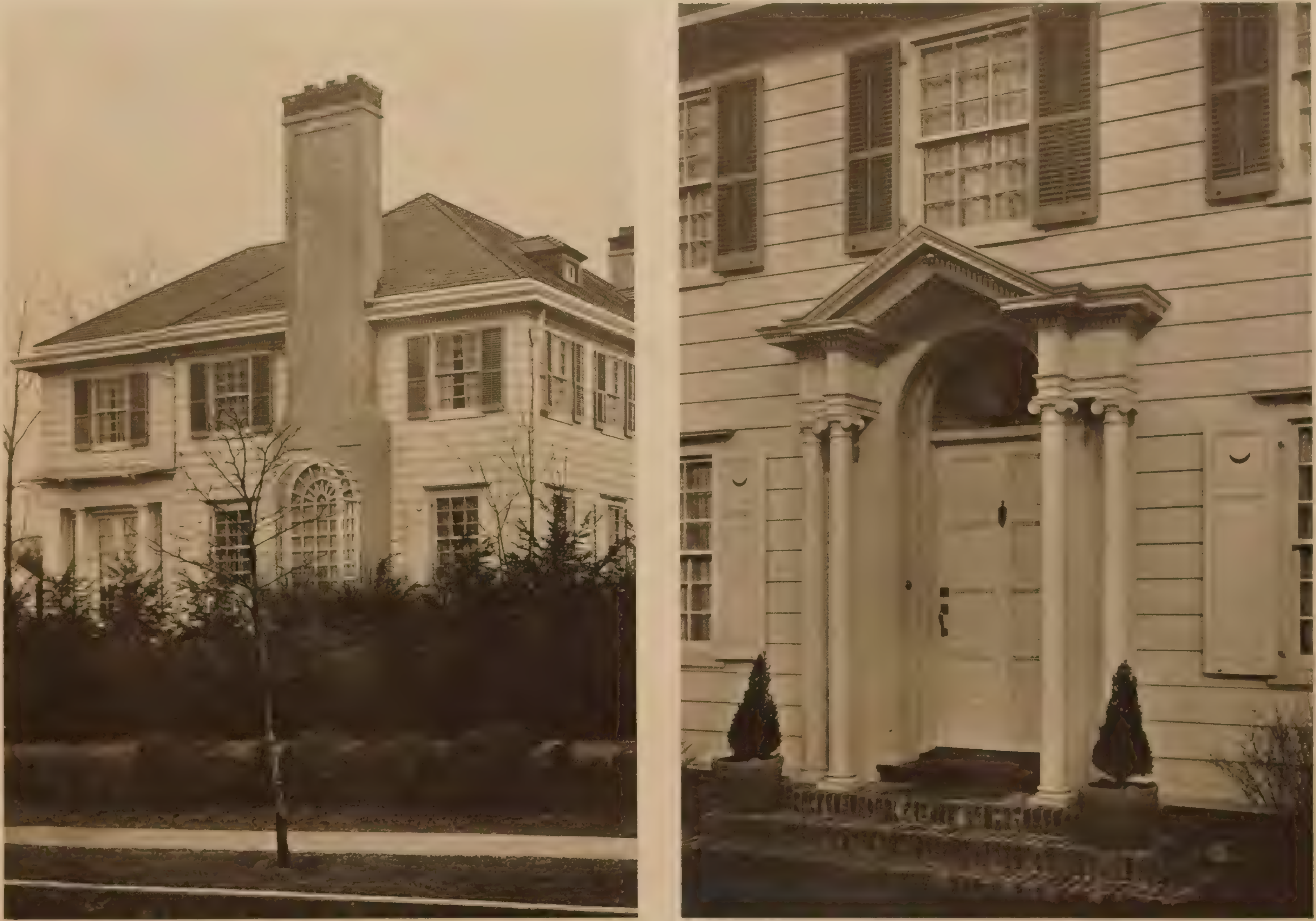
Dining Room.



Hall.

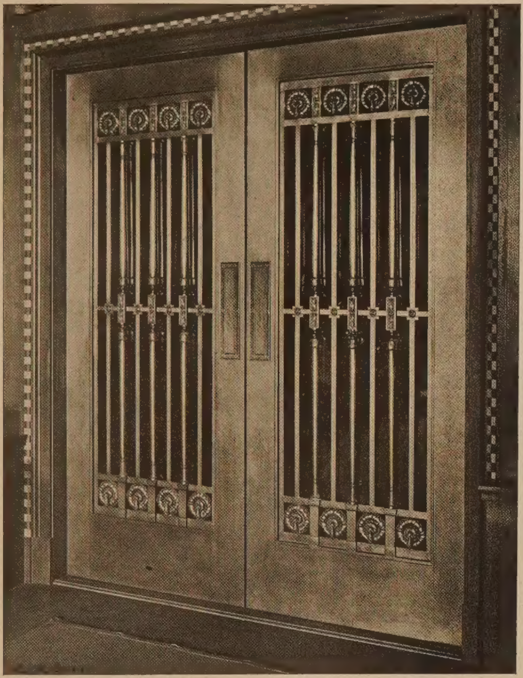
INTERIORS, HOUSE, F. H. NORTON, NUTLEY, N. J.

Armstrong & De Gelleke, Architects.



DETAILS, HOUSE, F. H. NORTON, NUTLEY, N. J.

Armstrong & De Gelleke, Architects.



BRONZE DOORS, EDISON SHOP, NEW YORK.

ANNUAL EXHIBITION, ARCHITECTURAL LEAGUE OF NEW YORK, 1915.

THE Architectural League of New York will round out its third decade of annual exhibitions during the coming exhibition season. The event of 1915 will open with the annual dinner on Friday, February 5th. The public exhibition will extend from Sunday, February 7th to Saturday, February 27th, inclusive. Public lectures will be given on Saturdays, February 13th, 20th and 27th.

The exhibition is illustrative of architecture and the allied fine arts. It will consist of drawings and models of proposed or executed work in structural, decorative and landscape architecture; sketches and finished examples of decorative painting; sketches, models and finished examples of decorative and monumental sculpture, *it being understood that full-sized portrait statues are not eligible unless especially solicited by the Jury of Selection;* drawings and models of works in the decorative arts; and photographs of executed work in any of the above branches.

THE HENRY O. AVERY PRIZE FOR SCULPTURE.

A prize of $50 presented by the late Mrs. Samuel P. Avery in memory of the late Henry O. Avery and a special prize of $300 will be awarded for the best design submitted by an architect, sculptor and mural painter in collaboration. Subject:—A small garden is surrounded by a wall 10 feet high. Through the center of the garden is a grass alley flanked by hedges 8 feet high and 10 feet apart forming a vista which is terminated by the wall. A fountain niche, pergola or other decorative garden feature is to terminate this vista.

This feature of the garden is the subject of the competition. All models shall be rendered at a scale of two inches to the foot; they must not exceed 30 inches in width, 30 inches in height and 15 inches in depth, and should indicate as far as possible the texture and color of the various materials used, including the garden wall. The judgment of the Committee of Awards will be based on the total effect of the design as a whole, and the degree of successful collaboration of the competing groups. The Avery Prize will be awarded on the sculptural element in this program, and the award of the Collaborative Prize will not render the work of the collaborating sculptor ineligible therefor.

THE EDISON SHOP. NEW YORK.

IN the gradual evolution of Fifth Avenue, New York, by which the former residential thoroughfare is being transformed into the city's most important avenue of trade, there is being developed a taste and variety in shop architecture which presents many points of merit and interest. From time to time ARCHITECTURE has published a number of the larger buildings and many of the smaller shops. The most recent of the latter is the Edison Shop, (Shape & Bready, Inc., architects), which is shown in a color frontispiece in this issue. The decoration of both exterior and interior is characterized by most unique design and color treatment. The extensive use of bronze and the excellent manner in which it has been applied in the decorative scheme is a matter worthy of attention. It is a product known as Bach Repoussé made of pure bronze, bearing all the qualities desirable for construction and durability, but which can be manufactured economically by this special process. The elevator doors, radiator grilles, etc., show the tool marks of craftsmanship and handwrought bronze. All the rugs are woven from special design and in colors to harmonize with the style employed in the treatment of the interior.

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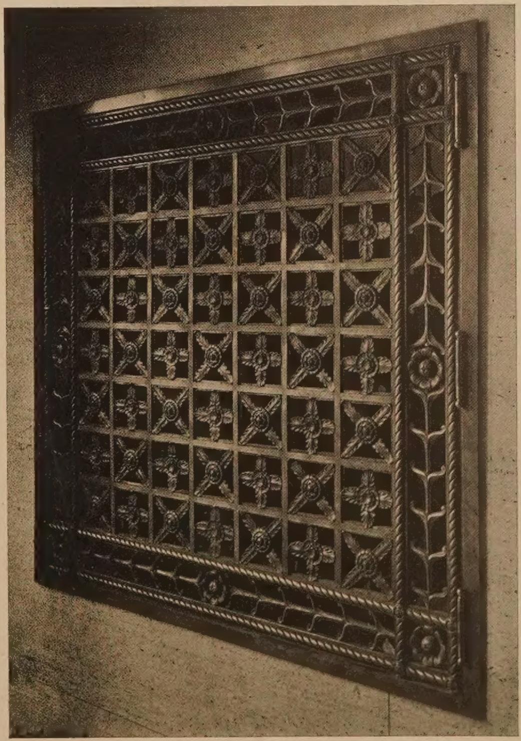

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New York Architectural Terra-Cotta Company

respectfully directs attention to the Swimming Pool in the Payne Whitney residence at Manhasset, Long Island, T. Markoe Robertson, Architect, illustrated by Plate CXXXIX this issue.

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